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To Show New Developments at Philadelphia Show

FOUNDRYMEN throughout the country are looking forward with great interest to the convention and exhibition of the American Foundrymen's association, which will be held at Philadelphia, May 14 to 18. Manufacturers of foundry equipment and supplies are making extensive preparations for their respective displays at the exhibition. Since the Detroit show in 1926, many equipment builders have spent considerable time and money in developing new types of equipment and in refining and perfecting other

types which previously have been in use. In view of the remarkable progress that has been made in the development of mechanical aids for foundrymen, more new equipment and more interesting developments undoubtedly will be featured at the 1928 exhibition than at any previous show in the history of the association. Reports from the headquarters of the American Foundrymen's association indicate that the exhibition will be exceptionally large. Seven-eighths of all available exhibition space in the Commercial museum already has been taken. Applications for space, which are being received daily, indicate that all space in the largest exhibit hall in the country soon will be taken for the largest exhibit in the foundry and allied industries since 1926. In addition to this valuable display of the best in the equipment field, a broad technical program has been arranged, where the various problems facing the ferrous and nonferrous foundrymen will be discussed.

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Grace and

Fig. 1—Realism and Careful Detail Shown in the Cornstalk Fence

MAN'S first instinct after he has foraged food, we are told, is to find shelter. Believers in Darwin's evolution theory that man descended from apes, probably will state that mankind's forbears lived in trees. Perhaps this is true, but to avoid an argument between the fundamentalist and evolutionist theories, it suffices to assume that man already had been in existence for a long period before shelter was sought.

Man's first urge to find some form of habitation was to shelter him from the depredations of the wild beasts that surrounded him and from the inclement elements. At first he may have lived in natural caves and later in others that he could dig in the sides of banks and hills. Perhaps he dwelt in pits covered with branches in the more level parts of the country which contained no banks or hills. As he became more observant, he noticed that the leaves and branches of trees shaded him from the sun and protected him from the rain.

In his travels he may have found trees where the heavily laden branches bent down to the earth and formed leafy bowers under which he could repose safe from the beasts, the sun and storms. This natural protection aroused his ingenuity and before long he discovered how to make shelters from screens composed of interlaced boughs. Next he made huts formed with a framework of branches which were arched by sticking the ends into the ground.

Evidences have been found in various European countries of circular houses formed of three concentric rings of stakes through which the branches of trees were interlaced to form the walls. Later, peaked houses were constructed by inclining four poles with a ridge pole between the two pairs of inclined timbers forming the ends. These were covered with blocks of turf with the grassy side inward. As his knowledge and inventive genius increased man tried other materials for covering the timbers and evolved the thatched roof, and then turned to the use of all timber construction. Later, the value of stone as a building material was discovered, but instead of finding new methods

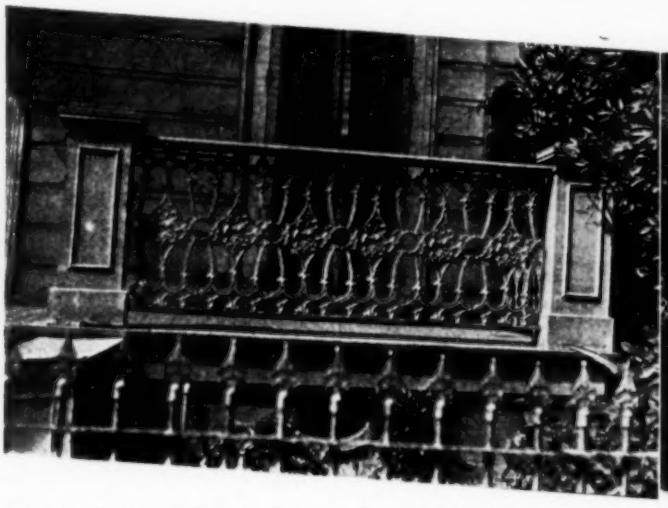


Fig. 2—Railing Panel of Cast Iron with Wooden Posts. *Fig. 3—Cast Iron Railings Around the Porch and on the Steps Distinguishes a Home in the Garden District of New Orleans*

Artistry Portrayed in Cast Iron

By Edwin Bremer

of construction, the builders employed the same ideas that were applied to timber hut design.

From time immemorial man has possessed a love of beauty, even though crudely expressed according to our present standards. As he became more adept in building, he devoted more time to the contemplation of his handiwork. To please his artistic sense he tried the effect of daubing his home with the bright colored earths he found. Liking the effect he went further, decorating his house with crude pictures of animals and his household gods.

Where stone was used in building, before the invention of carving tools, decorative effects were obtained by making on its surface these crude colored drawings. This manner of achieving decoration or ornament was succeeded by carving, and as man's knowledge of construction increased he enhanced his buildings with balconies, porches. steps, and columns. Just when metals first were used in structures for ornamental and decorative purposes is not known. The metals were used in the wrought form and in exceedingly small quantities as metals were valuable. When larger stocks came to hand the use expanded until both cast and wrought metal ornamentation became quite commonly employed in building adornment.

Probably iron first was used in the cast form during the fourteenth century. Plain fire backs set into the open fireplaces were made in open sand molds. Later the decorated surfaces appeared. These were made by pressing various objects into the sand forming the face of the open mold. Wood carving had reached a high state of perfection by this time, and with a wealth of designs at hand, experiments were made by impressing carved wood into the face of the mold. Some of the old firebacks show the application of this method to obtain their highly decorated surfaces. The designs usually were religious subjects. As the skill of the foundryman increased, he became adept at producing various patterns in cast iron, and found that this material was ideal for reproducing ornamental work repeatedly.

Soon these iron firebacks, andirons and similar parts were in large demand because the iron was a permanent material that resisted both fire and decay. It was cheaper than brass and bronze and its metallic lustre set off the design to the

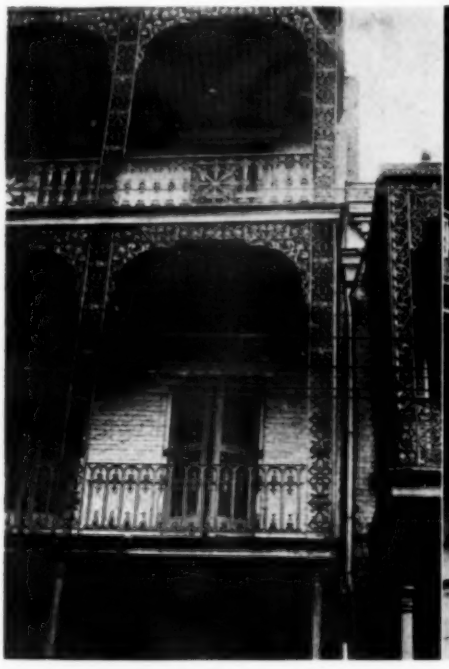
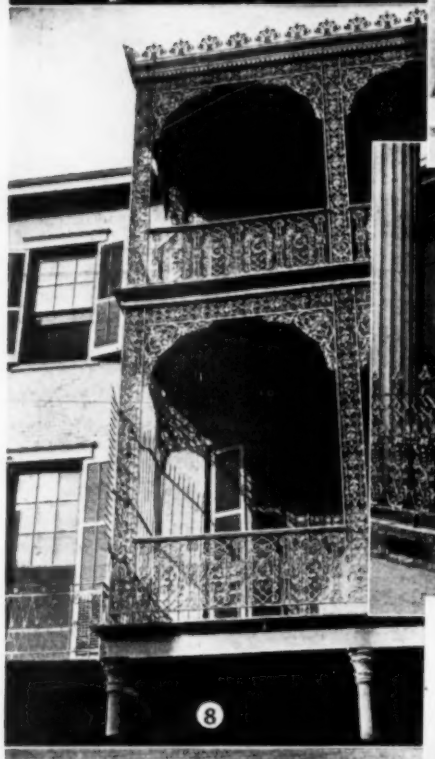


Fig. 4—A Combination of Empire and Renaissance Periods of Decoration. Fig. 5—Galleries on Royal Street with Cast Iron Panels and Supports. Fig. 6—Cast Iron Door at the Main Entrance of the Jesuit Church

Old New Orleans Adorned with Cast Iron



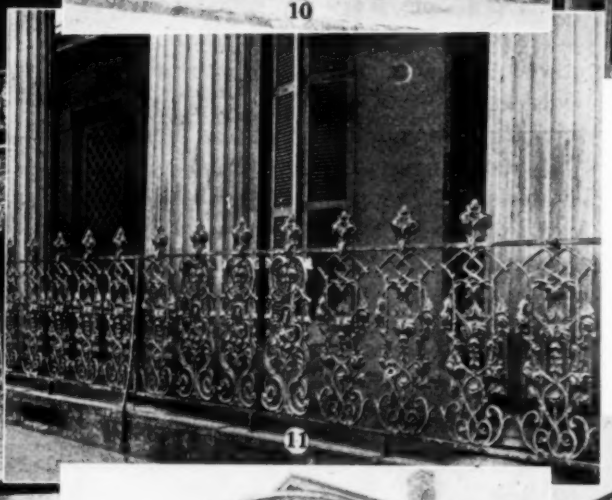
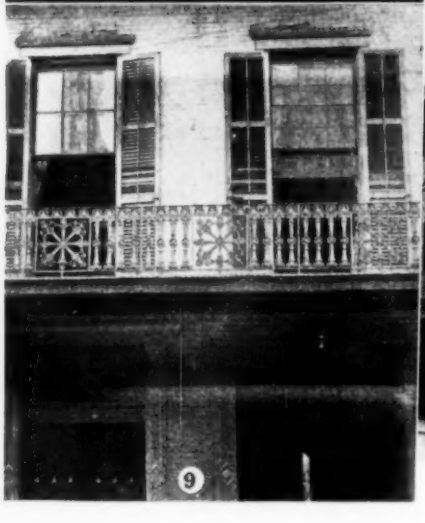
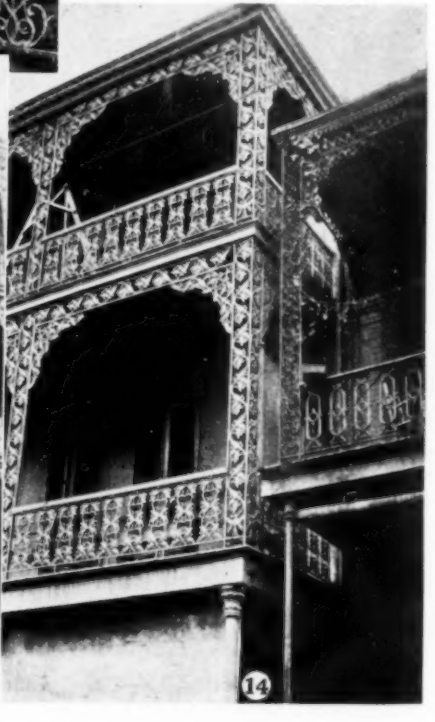


Fig. 7—Gallery of the Pontalba, Showing Monogram. Fig. 8—Splendid Example of the French Renaissance Design. Fig. 9—Contrast the Empire Design With That in Fig. 8. Fig. 10—The Home of Gayerre, Historian of Louisiana. Figs. 11, 12, 13 and 14—Further Examples of Cast Iron Ornamental Work as Used in the Older Sections of the City





best advantage. Appreciation grew for the craftsmanship, expert knowledge, effort and time required in its production.

Cast iron ornamentation in the period from 1700 to 1800 reached a high state of artistic perfection which did not detract from its use for utilitarian purposes. Specimens of the foundry art applied to architecture are found throughout Europe and America. Some splendid examples of this class of foundry product still are in use in the *Vieux Carre* or old French quarter of New Orleans which was founded by Bienville in 1718. New Orleans is one of the oldest settlements in the South and is rich in historic interest.

Although the city was founded in 1718, the government was not officially established there until 1722. The original settlement was on the Mississippi and formed part of what now is known as *Vieux Carre* which is included in a parallelogram that extends from Canal street to Esplanade avenue and from Rampart street to the river. The middle portion of this tract was set aside for a parade ground which was called Place d'Armes and now is Jackson park.

The French influence in New Orleans easily may be noted from the street names of Chartres, Royal, Burgundy, and many others. Royal and Chartres were the principal streets and contained the business houses and residences of the prominent people. A customary method of construction at that time was to build the houses two stories high with a court in the rear. The lower floor served as a place of business or professional operations for the master of the house and the upper floor became the living quarters.

Transferred to Spain

New Orleans came under the rule of Spain in 1762 when France, without consulting the people most interested, transferred the vast domain of Louisiana to that country. Although the populace of New Orleans did not relish the Spanish occupancy under Governor Don Antonio de Ulloa, no contrary action was taken until 1768 when a conspiracy headed by the leading citizens forced the governor to flee to Cuba. The citizens of New Orleans then discussed plans for forming a republic and sent delegates to the British-American colonies to plan for an American colonial union. Before anything permanent could be done, a new Spanish governor with an Irish name in the person of Don Alexandro O'Reilly took possession of the city and arrested 12 of the leaders of the agitation. Six of these were shot and the others imprisoned in Morro Castle, Cuba, which achieved such dark notoriety at a later period.

In March, 1780 a great fire practically destroyed the city. It began in Chartres street and swept away the central portion of the town including the commercial quarter, city hall and the homes of the leading citizens. Six years later another fire started in Royal street and in three hours demolished 212 dwellings and business houses in the heart of the city. The loss was estimated at $2,000,000, which was an enormous sum for that period.

However, like the proverbial ill wind, certain benefits resulted from this disastrous fire. Baron Carondelet, the governor at that time, offered a premium for tile-covered roofs. More thought was devoted to building construction and this resulted in better structures. The new homes and buildings followed the Spanish style with adobe or brick walls, arcades, inner courts, and with ponderous doors and windows. The walls were covered with a thin plaster or stucco coat, colored light blue, cream or greenish-gray, but seldom white.

Generally the walls were straight from base to parapet, unrelieved by horizontal band or cornice, and to break the monotony of the stark, bare walls, balconies or as they are known in New Orleans, galleries, with ornamental cast iron supports and railings were constructed. It seems rather odd that ornamental cast iron was used because the tendency of Spaniards was to employ wrought iron for this purpose. Several factors may account for this such as economy, the effect of the Napoleonic wars on trade conditions, and the ability of local foundries to supply such material in quantity at a cost far less than that demanded for wrought iron.

Other reasons given for the employment of cast iron were that once the pattern was made with its delicate and intricate lines, it easily could be reproduced any number of times. Another reason may have been that cast iron craftsmen were able to get away from architectural forms and ornaments of other nations. Further, the cast iron ornamentation has remarkable silhouette value. The sharply cut shadows cast on a wall behind gives a measure of relief and total contrast.

Designs used for the gallery supports and railings in New Orleans were combinations of the tulip, grape vine, rose vine, morning-glory, live oak and cornstalk motifs. The cornstalk pattern is of particular interest because it is found in two widely separated sections of the United States. In designing the senate chamber and house of representatives at Washington, Benjamin H. Latrobe, the noted architect, conceived what are known as the cornstalk column in the north wing and the tobacco plant capital in the colonnade of the south wing. These were hailed as the creation of a distinctive American order. Latrobe resigned his position at the Capital in 1818 and removed to New Orleans where he had been engaged with his son in constructing a water system.

Develops Cornstalk Design

This cornstalk design also is found in some cast-iron fences which adorned the estates of prominent families of New Orleans, one of which is shown in Fig. 1. One of the fences is around the old Leeds homestead which was built by Charles Leeds, head of the old Leeds foundry at which much of the decorative cast iron used at that time was produced. Although to many minds cast iron is a crude bulky material, an examination of the cornstalk fence in Fig. 1 easily refutes this belief. The jointed stalk with leaves and ears of corn faithfully are depicted with the slender twining morning-glory vine and blossom climbing to the top. At the center of the gate a butterfly with outspread wings is alighting upon an ear of corn.

Fig. 10 in contrast to the general method of using slender cast-iron columns an panel supports for the galleries, shows the gallery and roof supported on brackets. Another point of interest in this building is that it was the home of Gayerre, famous as the historian of Louisiana. Monograms were used to embellish some of the designs in railings, and this feature may be seen in Fig. 7. The

Portrayed in Cast Iron

THIS is the first of two articles describing the application of cast iron to ornamental purposes on the exterior of houses and buildings. The first deals with this material as used in the old section of New Orleans and the second will show modern examples that indicate a trend in popular taste. Illustrations for this article were supplied by I. T. Frary, director of publicity, Cleveland Museum of Art, Cleveland.

railings shown adorn the Pontalba buildings on Jackson square which were erected by Baroness Pontalba, daughter of Don Almonaster y Roxas. The monogram shows the union of the houses of Almonaster and Pontalba. It was on the balcony shown in Fig. 7 that Jenny Lind, the Swedish Nightingale, sat and viewed the square and watched the crowds, evenings when she was not singing. For this was her home during her stay at New Orleans when the liquid cadences of her wonderful voice enthralled thousands.

Lafitte, famous as a pirate who preyed on British shipping, and later fought valiantly in defense of New Orleans against the British under General Jackson, maintained a blacksmith shop in Chartres street up until 1810. One of the most daring plots for the rescue of a prisoner was hatched at New Orleans and the prisoner was Emperor Napoleon. Nicholas Girod, mayor of the city for several terms, and an enthusiastic admirer of Napoleon, was one of the engineers of the plot and was so confident in its success that he built a house to be used as a domicile for Napoleon in this country. Before the rescue could be made Napoleon died.

Cast Ornamental Work

Previously, reference has been made to the old Leeds foundry as producing much of the ornamental cast iron work used in the city. However, this was not the only firm engaged in this work. The old Shakespeare foundry was famous for the work turned out and a large number of the patterns were supplied by Wood & Pirot, who before the Civil war operated a foundry in Philadelphia and maintained offices in New Orleans and in Cuba.

Two splendid examples of the designs used for the ornamental cast iron work are shown in Figs. 8 and 9. Fig. 9 is a conventional design of the Empire period. Its less ornate and heavier appearing type of design contrasts greatly with that shown in Fig. 8, which is French Renaissance. Here the narrow intertwining bands lend an airy grace to the whole. Usually, the galleries on each building employed one design or motif throughout, but occasionally as in Fig. 4 designs of different periods were employed. A combination of Empire and Renaissance are shown which seems to indicate that the ornamental cast iron was produced in quantity, and one after inspecting the manufacturer's catalog, could order the required amount of any design that suited his particular artistic taste.

As near as can be determined the period when decorative cast iron was at its height in New Orleans was from 1850 to 1860. The Civil war ended all building operations and the subsequent impoverishment made revival difficult. Consequently, as Prof. Woodward, Tulane university, New Orleans, who has made a study of wrought and cast iron work of the city states:

"One may say that this type of architectural ornament passed out with the Civil war."

Employment Widespread

Although the ornamental cast iron work of New Orleans is described at length, it must be remembered that other localities used cast iron extensively. Old inhabitants of New York city can remember the grape vine and other designs which were used for the cast-iron fences that enclosed the lawns of the homes in the residential section. Robert E. Masters, an old-time foundryman and contributor to THE FOUNDRY, states that he can remember back as far as 1854 when he was a boy, cast-iron fences surrounded the homes on Thirty-fourth street, New York, where he lived, and that even then the fences were old.

Cast-iron ornamentation was used to a great extent in Buffalo, Cincinnati, Youngstown, O., Philadelphia, Cleveland, St. Louis and other cities and towns too numerous to mention. Many examples of this type of architectural decoration still are to be seen on some of the old homes still standing in these cities. However, not all pieces exhibit a pleasing design and many were a hodge-podge of everything. This was not the fault of the foundryman, but of the period when any carpenter who had glanced at a book on architecture proclaimed himself a designer and builder. Consequently, many monstrosities were designed and erected during this period, and the designs in cast-iron embellishments followed the same peculiarities in style.

After some years of jig-saw houses, ornamented with ginger-bread knick-knacks, and atrociously designed cast-iron railings and balconies, a prejudice against this type of architecture became evident and the pendulum of good taste swung to the opposite extreme. Since cast-iron was used extensively during the decadent period in American architecture, it came under the ban and for many years was neglected. In the past quarter century if any one had any admiration for some of the really good cast-iron pieces that had been made, he carefully kept the secret to himself.

However, in recent years people with artistic discrimination have seen the possibilities of cast iron ornamentation when designed properly and judiciously applied. Cast iron as a medium for the expression of artistry and craftsmanship based on present day standards will be described in a later article.

Completes Schedule for Barcelona Meeting

Arrangements for the meetings and the post convention tour to be held in conjunction with the Congreso Internacional de Fundicio or International Congress of Foundrymen to be held at Barcelona, Spain, from April 11 to 14 recently have been completed. The schedule follows: April 11—Morning—open meeting; afternoon—visit Maquinista Terrestre y Maritima and Hispano-Suiza Motor works. April 12—Morning—business meeting; afternoon—visit meter factory and the Grau foundry. April 13—Morning—business meeting; afternoon—visit May & Baga and Escorsa foundries. April 14—Morning—visit Sert factory and Industrial school; afternoon—closing meeting of congress. April 15 leave Barcelona at 8:35 a. m. for Valencia, arriving at 5:31 p. m. April 16—Morning—visit iron works at Sagonte; afternoon—free. Leave Valencia at 8:50 p. m. for Seville, arriving at 3:25 p. m. next day, April 17. April 18—Morning—visit the Military Munitions factory and Artillery works; afternoon—visit the Ibero-American exhibition. Leave Seville at 9:05 p. m. for Cordova, arriving at 11:35 p. m. April 19—Morning—free; afternoon—visit Societe Electro-Mecania. April 20—Morning—excursion to Pennaroya Electro-Mettalugica returning in the afternoon. April 21—Morning—leave at 11:19 a. m. for Madrid, arriving at 8:30 p. m. April 22—Morning—reception by town committee; afternoon—free. April 23—Morning—visit arms factory at Toledo and return in afternoon. April 24—Morning—visit railway works and Central Artillery laboratory; afternoon—reception at Royal palace. Leave Madrid at 9:30 p. m. for Bilbao, arriving at 8:22 a. m. next day. April 25—Morning—reception by town committee; afternoon—excursion on river. April 26—Morning—free; afternoon—leave Bilbao at 2:45 p. m. for Eibar, arriving at 4:33 p. m. Visit arms factory at Eibar, leaving at 7:25 p. m. for San Sebastian, arriving at 9:30 p. m. April 27—Morning—excursion to Beasain and return.

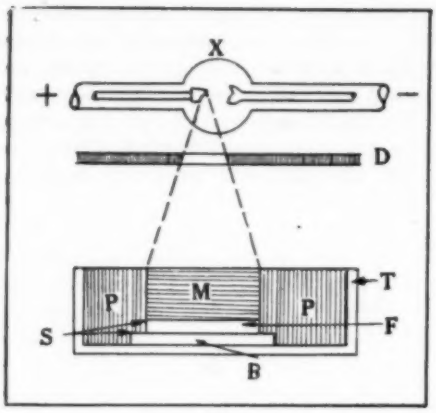


Fig. 1—Schematic radiographic arrangement for metal radioscopy with photographic plate

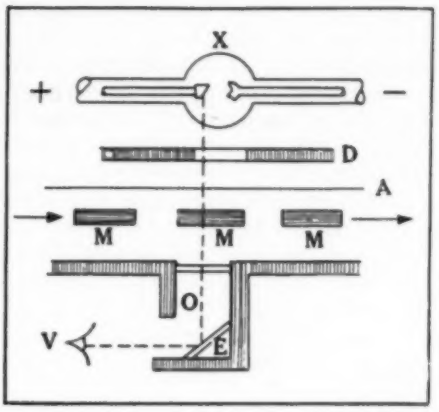


Fig. 2—Arrangement for X-ray examination of simple pieces of small thickness

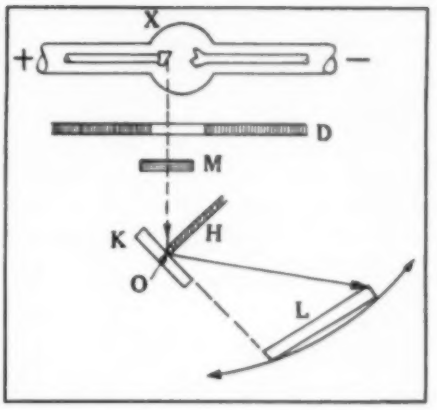


Fig. 3—Schematic X-ray arrangement based on the method of selective absorption

Using X-Rays To Inspect Materials for Internal Defects

By Herbert R. Isenburger

THE interest of materials examining laboratories, particularly those performing a more practical work, more and more turns to the new methods of examination made possible by the use of X-rays. Chiefly there are three new methods of research, based on the three qualities characteristic of the short electromagnetic waves: 1—Their penetrating power; 2—their selective absorption of certain wave lengths different for each element; and 3—their diffraction in crystals.

The method of examination, which we shall designate "Metal Radioscopy," is based on the penetrating power of the X-rays. It refers to the testing of raw materials or half-finished manufactures of high value such as castings, soldered or welding seams, etc., for faults within the materials which may be aluminum, zinc, tin, copper, brass, iron, steel, porcelain, rubber, carbon, etc.

The piece of work lies between the focus and the plate or fluorescent screen. An irregularity in the density of the plate not caused by an exterior treatment or in the fluorescence of the screen, indicates the location of the defects. Fig. 1 schematically shows a radiographic arrangement for metal radioscopy with photographic plate.

With larger pieces and increased tensions, the fogging influence of the stray radiation arising in the piece under investigation is highly remarkable. The outlines become soft, the variations in opacity diminish owing to the general fog and thereby the visibility of the contrasts becomes reduced. To some extent this difficulty can be removed by the employment of movable diaphragms such as the Bucky diaphragm used in medical diagnostics, if one agrees to considerably lengthened periods of exposure.

High Capacity Apparatus Needed

For the purpose of metal radioscopy, relatively high tensions on the X-ray tube are required, if the limits of a reasonable exposure shall not be exceeded, that is, apparatus and tubes for high tensions and capacity are necessary.

The target-plate distance, too, requires a high milliamperage discharging through the tube and, therefore, a great penetrating power and intensity of the radiation. The distance generally has to be a great one, to obtain with the large extension of the focus sharply-defined outlines of the defects. Small target distance produces haziness of the minor defects due to the breadth of the focus, which makes it difficult to recognize them. Therefore, tubes of a great capacity with a focus in the form of a dash preferably should be used. These tubes should be installed in such a manner that their focus seen from the object seems like a point, however, these tubes have a disadvantage in that they can withstand but relatively low charges.

An excessive increase in the voltage is not advisable, as the contrast-producing effect of the rays decreases in proportion to their hardness. Recent researches show that the eye is most sensitive to differences of the density in the range of a base opacity of about 0.6 to 1.0 on the photographic plate.

With 20-inch target distance, 4 milliamperes and 150 kilovolt continuous current voltage, a perfect density (density after deduction of the fog) of 0.6 behind 1 inch of iron can be obtained in 40 seconds by using films with an intensifying screen. Behind 2 inches of iron, 225 kilovolts and under otherwise the same conditions, the same opacity can be attained in about 35 min-

Meaning of Symbols Used in Figures

A—Movable table for automatic passing of material under investigation before fluorescent screen
B—Sheet brass as protection against self-radiation of the lead emitted
C—Fluorescent screen
D—Lead diaphragm
E—Mirror
F—Dublitized film
G—Cathode of a gas tube
H—Edge of screening out the primary ray
I—Film
K—Crystal
L—Plate
M—Material for research
N—Anticathode
O—Center of rotation of the system
P—Lead shot as protection against secondary rays from the walls or from objects of the testing room
R—Diffracted ray
S—Intensifying screen
T—Lead tank
U—Primary ray
V—Viewer
X—X-ray tube

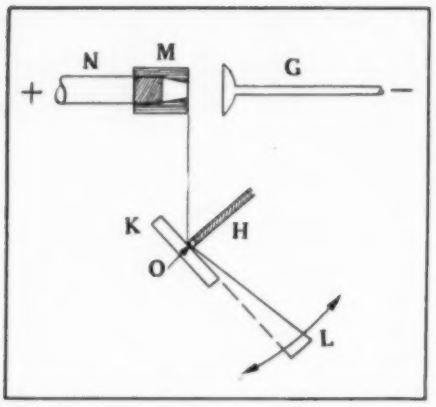


Fig. 4—The line-emission method is employed for quantitative chemical analysis

utes with the examining X-ray tube.

Fig. 2 shows an arrangement as made with pieces of a small thickness or of an inferior ordinal number (low absorption coefficient), where the end radiation emitted behind the pieces under investigation, is still great enough to stir up a fluorescent screen to an effective fluorescence radiation.

The limits of the metal radioscopy already are within sight today. In larger pieces, formations as thin as a hair are seldom to be proved, and air bubbles, only if their thickness in the direction of the beam does not amount to less than about 5 per cent of the total material thickness at this spot. With more than about 5 inches of aluminum, 2½ inches of iron and about 3 inches of brass, satisfactory results scarcely are to be obtained.

May Become Routine

Of great importance, however, are the examinations by X-rays of castings, except lead, which frequently have blow holes or enclosures. These photographs, known as "exographs," are a great help to the entire metal industry and in the future up-to-date manufacturers will find it not only desirable but necessary to apply X-ray inspection as a matter of routine. For the investigation of welded or riveted joints on boiler connections and for fluoroscopy of building stones or insulating materials, too, the method may be of great value.

The second method of research by means of X-rays is based on the phenomenon that the elements selectively absorb certain wavelengths characteristic of them or even on the phenomenon connected with it that elements hit by cathode or X-rays emit a radiation of quite a definite wave length.

The method based on selective absorption is schematically reproduced in Fig. 3, has been particularly elaborated by R. Glockner in "Die Verwendung der Roentgenstrahlen zur Quantitativen Chemischen Analyse." The situation of the absorption leap in the heterogeneous mixture of rays, decomposed into their single wave lengths by diffraction on a crystal, establishes the nature, the dimension of the absorption leap determined by photometering, and the quantity of the element existing in the material under investigation.

The material is equally well fitted for research in any physical condition such as sheet metal, powder or liquid in a jar and even as gas, presupposing suitable conditions for research. The method is adapted to the research of alloys; of impurities, particularly of undesirable admixtures in the manufacture of glass; and, in a more scientific sense, for the analysis of the rare earths, etc.

This method of research based on line-emission and designated with line-spectroscopy, is schematically reproduced in Fig. 4. It is employed for quantitative chemical analysis. The material is fastened to the anticathode of a kenetrone tube with interchangeable anticathode or a gas tube which is connected with a pump, and the lines of the self-radiation are photographed in a spectrograph. For a long time this method of research has proven its worth in qualitative respects. The new element hafnium was discovered by it, as generally the X-ray analysis represents a competent means in the range of rare earths which are chemically difficult to be separated. Even with smallest quantities this analysis guarantees good results. It is of great advantage that there is no consumption of the materials either with the method of absorption or with the method of emission.

For the techniques of radiography in quantitative researches it is important that the tube voltage is not substantially increased beyond the limit of stimulation of the element under investigation, lest the initial highly-increasing diffuse spectrum of second order should render difficult the estimate of the leap in the differences of density, or even falsify it by an accidental coincidence of the end of short wave lengths of the diffuse radiation with the absorption band edge. The same is valid in the emission method, otherwise the energy of the diffuse spectrum of the same direction may be neglected due to the employed direction of emission of the self radiation parallel to the striking cathode rays.

Therefore, those elements lying in the periodical system under chromium (Z-24) can no more be analyzed, because their K-emission lines or (with the absorption method) the wave lengths near to their K-absorption leap are too soft even for emitting through a Lindemann window. If you want to analyze elements still lower in the periodical system, a vacuum spectrograph has to be taken which allows the analysis up to sodium (Z-11). For instance Siegbahn constructed such a device and used it for his measurements. The highest tension to be considered in chemical analysis is about 1.3 times the stimulating tension for uranium for the K-series, consequently about 140 kilovolts.

Various Methods Available

The possibilities of materials examination by the third method, diffraction in crystals, nowadays seems to have the best prospects, but their full importance cannot yet be estimated finally.

The method is based upon the diffraction of X-rays on the atom planes of the crystals, which occurs under a varying angle of incidence according to the spacing of the atom planes and the wave length of the striking X-rays. Nearly all the technical materials, particularly the metals, show a crystalline structure and, in the radiation with a beam of X-rays finely screened under a definite angle, interferences appear, the intensity and direction of which are reproduced on the film of plate. From this the situation and the spacing of the reflecting atom planes as well as the density and nature of their atom coating can be revealed. In this way, for example, the crystalline structure of the substance decisive for its mechanical qualities, can be ascertained or may be compared with other materials of known mechanical qualities.

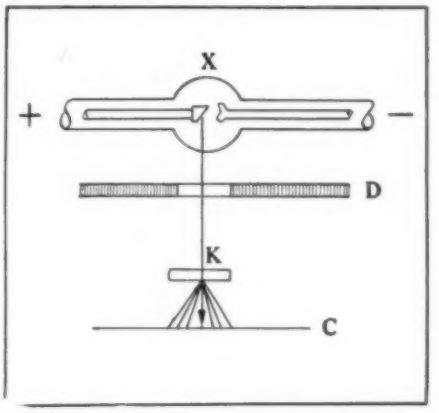


Fig. 5—The Laue method of examination in which a fixed crystal is used

It is impossible here to give full details of the different methods of the examination of material structure by X-rays, but the most important may be mentioned as follows:

1—the classical Laue method in which the heterogeneous X-rays meet a fixed crystal and bring out interferences in a definite direction. (Fig. 5).

2—The Bragg method in which a monochromatic radiation falls on a rotating crystal. (Fig. 6).

3—The Debye-Scherrer method in which a monocromatic radiation falls on crystals in an irregular arrangement, for instance, substances in powder form. (Fig. 7).

For the research of fiber structures, as to the influence of rolling, glowing, storing, electrolytic liberation, etc., the principle of Laue's arrangement is employed. A monochromatic radiation as a small beam falls on the coherent material under investigation, for example, rolled sheet or electrolytic deposit.

For the actual examinations of the different kinds of iron for their amalgamation with carbon or oxygen as well as for the observation of temperatures in which the metals change their structure, the investigation by X-rays supplies new and important means which are able to complete the existing metallographic methods in the best manner. For instance, the hardening of steel by atoms of carbon which are interspersed into the original lattice of the alpha iron and enlarges its length of edge by about 1 per cent according to Wever's investigations, becomes comprehensible from the tensions hereby forced on the elementary lattice.

As a further advantage, it may be mentioned that in using suitable cameras, the examination of the different materials is possible with high as well as low temperatures. Recently Glockner also employed X-rays to determine in electrolysis the influence of the current density and the solution as-

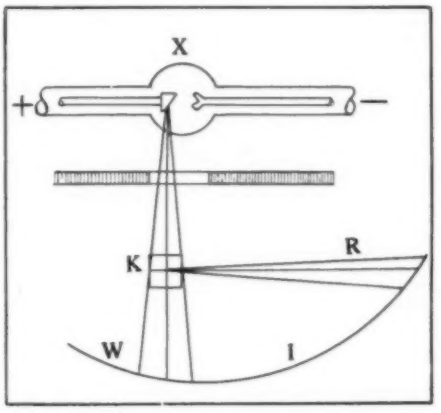


Fig. 6—In the Bragg method of examination the radiation falls on a rotating crystal

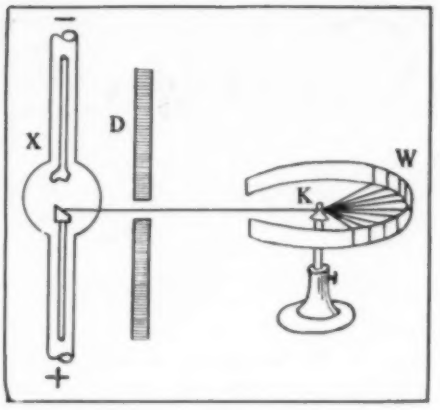


Fig. 7—Radiation falls on crystals in an irregular arrangement in the Debye-Scherrer method

sociated on the more or less marked orientation of the fiber structure. Finally, the fluoroscopy by X-rays gives an insight into the change of direction of the crystals by rolling, hammering or pressing and into the recommencing recrystallization (aging) thus we obtain an understanding for the increase in strength of metals by treatment and for the variation of this strength with time.

As this physical range is in the course of development more than any other at present, and new possibilities of use are arising, it would be useless to give more than a general idea of the existing methods of application. Nevertheless the theoretical preliminary studies in the physical institutes already are so far advanced that industrial laboratories are compelled to give X-ray their attention in applying it in their individual cases.

Steel Treaters Discuss Metallurgical Papers

Meeting for the first time outside the United States, the American Society for Steel Treating conducted its semiannual meeting at Montreal, Que., Feb. 16-17, with approximately 250 attending. Among the notable technical papers presented at the meeting was one by R. G. Guthrie, Peoples Gas Light & Coke Co., Chicago, and J. Fletcher Harper, Allis-Chalmers Mfg. Co., Milwaukee, describing some new and interesting discoveries in crystal micrography. By a special preparation of specimens, which eliminated the "amorphous or plane film," the investigators were enabled to photograph the crystals in grains of metal.

Generalities in the manufacture of chrome iron castings were discussed in a paper by V. T. Malcolm, metallurgical engineer, Chapman Valve Mfg. Co., Indian Orchard, Mass., and V. O. Homerberg, professor of metallography, Massachusetts Institute of Technology, Cambridge, Mass. The paper co-related facts pertaining to these castings, containing low carbon and 16 to 20 per cent chromium. Manufacture of chrome iron castings presents a number of difficulties not well understood for the reason that the same practice as applied to ordinary carbon or alloy steels can not be used in the production of high-chrome irons.

The development of 16 to 20 per cent chrome iron with low carbon that does not require a heat treatment was retarded because of the difficulty of introducing chromium into iron and maintaining the low carbon, but research and development have made it possible to produce this material which is soft and malleable and can be machined without great difficulty. These castings are extremely sensitive to oxide inclusions in the making consequently practice must be standardized if good results in service are to be obtained.

To be a good commercial success, according to the authors, the material should have a dense structure free from tendency toward segregation; must not burn the sand in pouring; have a normal shrinkage; and give a casting that will clean readily. At the same time it should machine well and not be excessively hard.

According to the authors, the structure of the metal should be dense and the carbides finely dispersed, because it is their conclusion that the structure or grain of a metal plays an important part in its acid resisting qualities. It was recommended that manufacturers of stainless or chrome irons subject all castings to a white pickle, a pickle consisting of hydrochloric acid and later another pickle in nitric acid, which produces a film after which the steel will not corrode when subjected to atmospheric conditions.

Physical properties of the material were given as follows: Tensile strength, 100,000 pounds per square inch; yield point, 75,000 pounds; maximum allowable stress at 1000 degrees Fahr., 12,000 pounds; melting point, 2750 degrees Fahr.; scaling point maximum temperature for continuous operation, 1600 degrees Fahr. and specific gravity, 7.663; and thermal conductivity, less than one-third of iron.

It was announced at the meeting that Dr. W. H. Hatfield, Brown-Firth Laboratory, Sheffield, England, had accepted the invitation of the American Society for Steel Treating to be the Campbell Memorial lecturer at Philadelphia, Oct. 8-12.

Considers Cause of Variations *in Pig Iron Qualities*

By R. S. McCaffery

AMONG technical men at the present time, the belief that one iron has properties different from another iron of the same chemical composition generally is accepted as a fact and explanations have been offered to account for the differences. Generally two major theories have been advanced, which have been called the *oxygen* theory and the *rare elements* theory. The names are nearly self-explanatory. The arguments pro and con concerning these theories have been supported warmly and considerable literature has come into being as a result.

More lately, Fletcher, *Transactions*, American Foundrymen's association, vol. 33, developed some ideas which seem to have great merit and the work of Piwowarski and his associates, *Transactions*, American Foundrymen's association, vol. 34, in their study of cast irons of great strength have added additional information on this general subject. This paper is presented merely as the statement of a theory as to the cause of variation in the qualities of iron, which it is believed accords with the observed facts. It is in no wise a report of experimental research but it is the result of careful study of the problem and believed to be in accord with scientific principles. To the author at least, it does not require so expansive an imagination as do the older theories.

Pig iron or cast iron will always be found on chemical analysis to contain iron and manganese and carbon, silicon, sulphur and phosphorus. With the exception of part of the iron and carbon which may exist in the pig iron in the elemental form as ferrite and graphite, all the more common metallic constituents of the pig iron form compounds with the non-metallic constituents which may be present and binary compounds like carbide of iron, carbide of manganese, silicide of iron, silicide of manganese, sulphide of iron, sulphide of manganese, phosphide of iron and phosphide of manganese as well as possible compounds more complex than binaries, may be present in the iron.

Presents Explanation

FOUNDRYMEN realize that certain irons possess definite properties quite different from other irons of exactly the same chemical composition. Both the oxygen and rare elements theories have been used to explain the difference without much success. However, this article advances another theory that seems to be a more logical explanation of the variation of quality. This article is abstracted from a paper presented at the American Foundrymen's convention held in Chicago. The author is a professor, college of engineering and mechanics, University of Wisconsin, Madison, Wis.

In a blast furnace producing pig iron, the conditions are not uniform at any one time in the furnace nor are they uniform from day to day, and when two blast furnaces are compared the lack of uniformity becomes more apparent. In any horizontal section of a blast furnace, there is considerable variation in temperature and there is not a proportional change of temperature between the corresponding points in any two different horizontal sections. The result of this is that along any vertical line inside of a blast furnace there is at some fixed time a definite temperature gradient which is different from the temperature gradient along any other vertical line at the same time.

If a particle of ore that was charged into the top of the furnace descended through the furnace along one of these lines it would pass along a temperature gradient quite different to what a second particle would be subjected to along another path down the furnace. When the temperature gradients may be so different in various paths through one furnace, a still greater variety of temperature gradients are to be expected in two furnaces.

All chemical reactions have a definite free energy at a given temperature and with some reactions the free energy increases as the temperature rises, while with other reactions the free energy decreases with rising temperature. This means that all chemical reactions have a velocity that varies with the temperature and that chemical affinities vary with temperature.

It means, too, that when a number of chemical reactions are taking place simultaneously at a given temperature one reaction will predominate over the others. While at a different temperature another reaction will predominate, although a number of re-

Table I

Compound Compositions

	No. 1 Iron Per Cent	No. 2 Iron Per Cent
Iron Carbide	a	m
Iron Silicide	b	n
Iron Sulphide	c	p
Iron Phosphide	d	q
Manganese Carbide	e	r
Manganese Silicide	f	s
Manganese Sulphide	g	t
Manganese Phosphide	h	u

Table II

Chemical Analyses

	No. 1 Iron Per Cent	No. 2 Iron Per Cent
Iron	J	J
Manganese	K	K
Carbon	L	L
Silicon	M	M
Sulphur	N	N
Phosphorus	P	P

actions may all be taking place at the same time to a greater or lesser degree. Many of you are familiar with the fact that in *normal* bessemer blows, the silicon first is oxidized and afterwards the carbon is blown out; whereas, in a blow that starts at an initially higher temperature, the silicon is eliminated after the carbon.

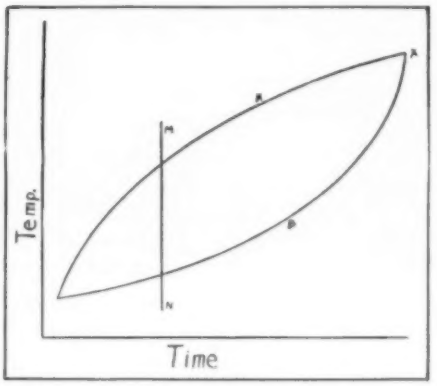
Similarly in a basic open hearth heat, normally the phosphorus is taken out first and the heat finished on carbon but by beginning a heat at a high initial temperature, the carbon may be removed first and the phosphorus may remain to the last. In malleable air furnace heats, too, the order of elimination of impurities from the bath may be varied by control of the bath temperatures.

The importance of this point and its full significance is emphasized by reference to the diagram. Two baths of molten metal, both of the same initial temperature and compound composition and in each of which reactions are taking place, are heated. In the same total time, both reach the same final temperature, one passing along the temperature gradient *A* while the other passes along *B*. Let us consider what is happening at the time represented by the line *m*, *n*. In the bath *A*, a number of reactions are taking place at the same time and each is producing its own end product.

All of them are progressing at different rates, and one reaction is predominating over the others. In the bath *B*, at the point *n*, the same reactions are occurring but at *different* rates because the temperature is *lower* than at *m* in bath *A* and a different reaction may be predominating. In any event, since the rates of reaction as different at *m* and *n*, the bath compositions are different. Similarly at other equal time points along *A* and *B*, the reactions proceed at different rates till the point *X* is reached, which is at the same time in each bath but by proceeding along a different temperature gradient. The result is, the two baths now at temperature *X* are not of the same compound composition although both started with the same composition and in the same time reached the same final temperature. It is assumed that the heating of the metal baths was carried on at an economic or commercial rate and that equilibrium was never attained, or in ordinary words, common practice in heating was followed.

The fact that two molten metal baths may reach the same temperature in the same time but be of different compound composition is a point of considerable importance that is overlooked in plants, and it may account for variations in the properties of heats of the same chemical composition that are explained usually in various other ways.

In the blast furnace, there is a series of reactions taking place. The velocities of these reactions change with the furnace temperature. In the passage of the particles down the furnace the temperature rises and the order of the reactions keeps changing. All parts of the charge are not carried down the shaft along the same temperature gradient, so that the reactions are not taking place uniformly at one place in the furnace and uniformity of conditions is not maintained. Then, too, there are irregularities in the operation of any



GRAPHICAL REPRESENTATION OF TEMPERATURE-TIME CHANGES IN TWO BATHS OF MOLTEN METAL

blast furnace due to the changes that are taking place in various operating factors, and the same *average* temperature gradient does not persist from hour to hour, let alone from day to day. The reactions that take place in the furnace produce the various carbides, silicides, sulphides and phosphides of iron and manganese.

It can be seen, then, that along different temperature gradients, one kind of iron of a definite compound composition may be produced by passage along one temperature path while iron of different compound composition results from taking another path. It may be, too, that while the compound composition is different in the two cases, the chemical composition may be the same. For example, the carbon may be present all as carbide and in one iron the iron carbide might be high and the manganese carbide might be low while in the second the iron carbide might be low and the manganese carbide high, although the carbon might remain exactly the same in the two irons.

The properties of the iron are not entirely due directly to its chemical composition, but its compound composition may profoundly influence its properties.

If two pig irons are of the composition indicated in Table I they may have the same chemical composition as shown in Table II; but, because their compound compositions are different (although the chemical analyses are the same), the properties of the two will be different.

It may be objected that the amounts of some of the compounds which might be present will be small and therefore their influence on the properties of the iron will be slight. It is known, however, that relatively small amounts of compounds will affect the properties of steel to an important extent. The presence of sulphur as a compound of iron, as FeS, or of manganeses, as MnS, is a case in point. The higher melting point of the manganese sulphide causes it to separate in grain interiors instead of on grain boundaries as does the lower melting point iron sulphide and it thus changes materially the brittleness of the steel, The amount of these compounds, too, will be larger than the content of *rare elements* or of *oxygen* or other gases which has satisfied the supporters of some of the other theories.

The theory outlined in this paper has been reduced to its simplest form; for one thing, the effect of solubility of constituents has not been considered. In its most elementary outline, it indicates how the relative amounts of compounds which may be present in pig iron might change, due to variation in blast furnace operating conditions. When we consider that some of these compounds may vary by considerable percentages, the variation in the properties of pig irons of similar analysis but produced under different conditions does not seem so extraordinary.

It has been noted repeatedly that certain irons retain their characteristics to a greater or less extent after remelting a number of times. If this be so, it gives additional support to the proposed new theory. Certain temperature conditions in the blast furnace cause some reaction to predominate at definite temperatures and produce definite end products or compounds in the iron. If then on remelting, this temperature range in which the compounds were formed in the blast furnace is not attained, or if it should be reached but only for a short time, then the compounds formed at the higher temperatures persist, and the iron only liquefies.

On cooling and solidifying again, it has the same or approximately the

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Sugar Mill Castings Made *in* Loam

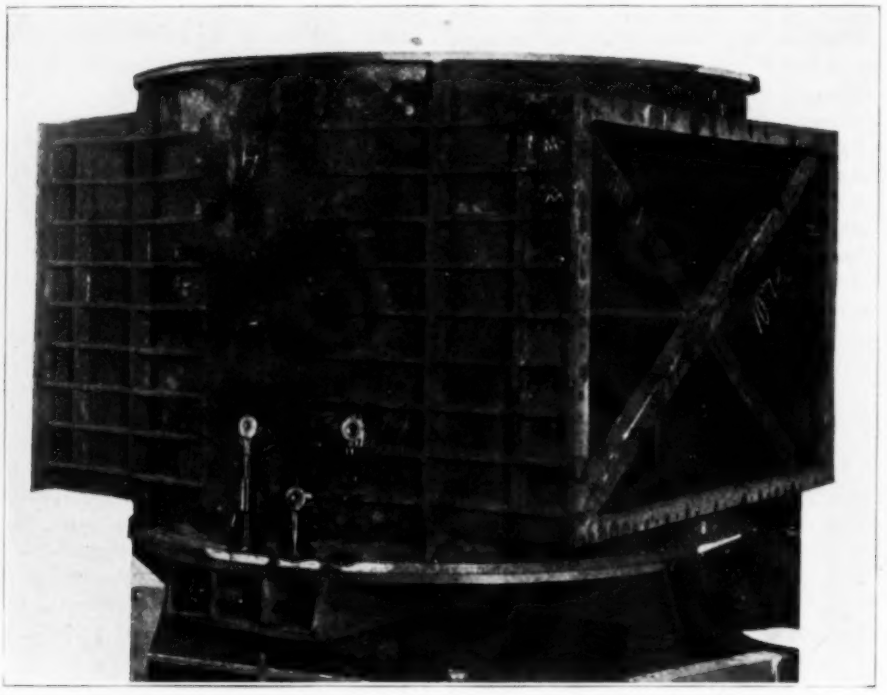


Fig. 1—Completed Casting as It Appeared on the Erecting Floor Before Being Shipped to Its Destination

FOR many years the Kilby Mfg. Co., Cleveland, has been engaged in the production of sugar-making equipment for the mills and plantations in this and foreign countries. Many of the castings, particularly those that go to make up the evaporators are large in area but comparatively light in metal section. They must present a clean and smooth skin and must be homogenous throughout to withstand a water test.

As in practically every other manufacturing field, while the basic principles of sugar making have not changed, methods and process have moved steadily along economic lines with a resultant modification in the design of many of the castings. Duplicate sugar mills are the exception rather than the rule. As a result pattern equipment for the castings for one mill rarely is of any use for subsequent orders.

For the foregoing reasons loam molding is resorted to extensively in the production of these castings. Incidentally, the loam mold furnishes insurance against many of the hazards incident to the casting industry. It is dry, therefore no danger exists from steam, the great producer of scabs, dirt and blowholes. It is hard and firm and as a result the casting will be true to form and dimension. In many instances the entire mold is formed by sweeps attached to a central spindle.

Under normal conditions, with nothing to prevent uniform contraction, a casting made in this manner will more nearly approach the shape of a true circle than one molded from a wood pattern. Dampness sometimes plays queer tricks on patterns left in the sand for extended periods.

Finally, although the face of the loam mold is hard and firm, thus insuring a casting smooth and true to shape, still the loam of which the mold is composed is so permeable that the gas generated passes through it readily and does not cause any commotion in the liquid iron. This feature also prevents the formation of scabs and *cuts*. Tight loam, or loam that is not sufficiently dried, will flake off the face of the mold. Iron takes its place in the form known as a scab. *Rotten* loam, that is loam without sufficient bonding material, will disintegrate under the force of the metal stream and wash away. In the foundry, the torn area is referred to as a *wash* or a *cut*. However, these conditions do not obtain where a standard loam mixture is applied by skilled molders.

A typical casting for a sugar mill evaporator installation is shown in Fig. 1 with the mold Fig. 2 and the core Fig. 3. This particular casting rests upon a saucer base and supports several other more or less plain circular castings surmounted by a dome. The entire assemblage extends upward to a height of 40 feet, and is machined and fitted in its entirety before it leaves the shops.

Perhaps a more intelligent conception of the size and shape of the castings might be gained from the presentation of a few figures. The casting is circular, 10 feet inside diameter, 8 feet in height, including a 6-inch extension of the upper flange to serve as a feeder and dirt catcher. A rectangular branch on each side with a 5-foot, 4-inch x 8-foot, 6-inch opening is reinforced by two vertical and nine horizontal ribs 6 inches deep. The casting is flanged top and bottom. It weighs 18,000 pounds and presents a uniform metal thickness of 1 inch and making the mold occupies the time of two men, a molder and an advanced apprentice for two weeks.

To facilitate stripping the casting, it was molded partly below and partly above the floor level as may be noted in the illustration Fig. 2, where the upper part of the mold is shown enclosed in two steel curbing bands. Weights were employed instead of binders and bolts to hold the various parts of the mold in place during the pouring operation.

Iron was poured from two ladles on opposite sides of the mold. From the basins it passed down through four vertical runners and entered the mold through a number of narrow horizontal gates, ¾ x 4 inches, spaced approximately 10 inches apart over the entire clear area between the two sets of reinforcing ribs. The runner

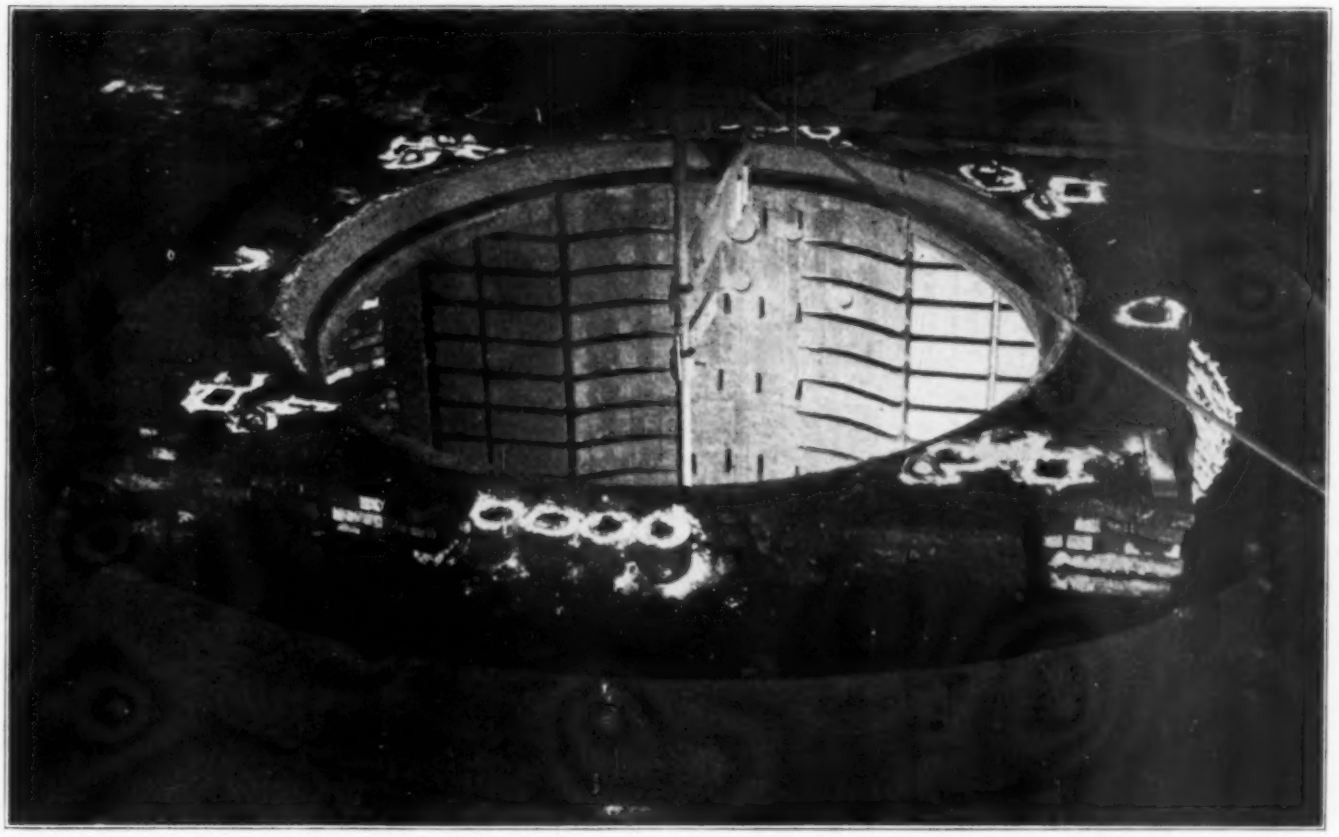


Fig. 2—Outside of the Mold With the Drawbacks in Place Over the Branches and With the Rib Patterns Removed from the Vertical Wall

cores are shown quite distinctly in the foreground of Fig. 2 and a number of the inlet gates on the opposite side also appear quite clearly. With this style of gating it is claimed the mold is filled gently from the bottom and with a constant supply of fresh hot iron coming in from the upper gates as the metal in the mold reaches their level.

Pattern equipment consisted of several sweeps to be attached to the arm on a central spindle, a light frame to be used as a guide in building the branches, a number of lagging strips, 1 x 3 inches, laid against the core to form the metal thickness, and the reinforcing ribs. The various parts were prepared in the pattern shop, but were fitted and assembled on the job in the foundry.

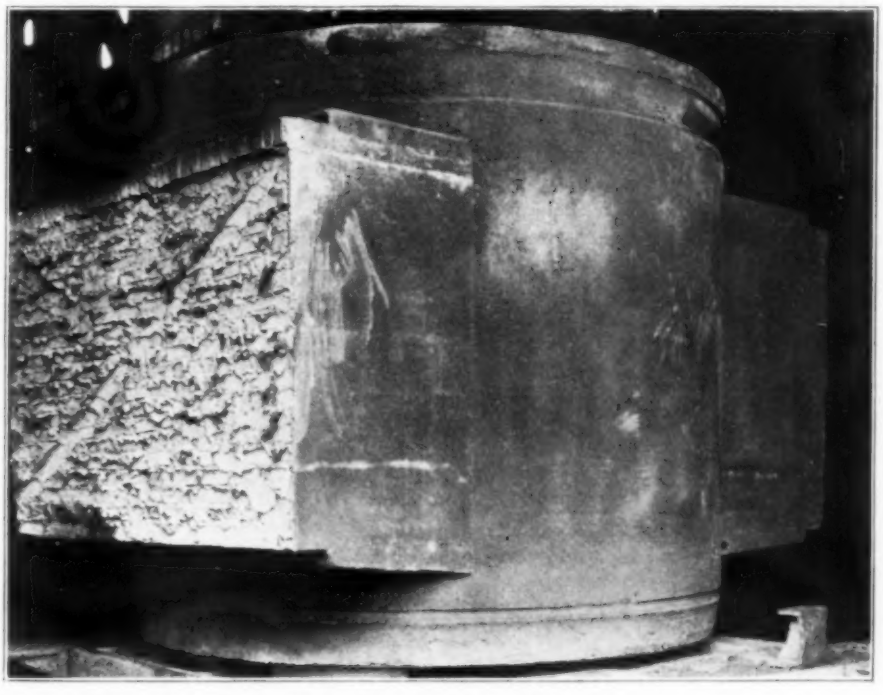


Fig. 3—The Main Core, Body and Branches Was Built and Handled as a Single Unit

Cast-iron rigging required for the job included a heavy circular lifting ring for the core; two long plates extending from side to side of the branches to support the overhang; two plates for supporting the drawbacks over the branches and a top or cap ring to reinforce the top of the wall and present a support for the weights and if necessary the lifting cross. The long plate supporting the overhang in the branches was split in two parts and a gap was left between the two halves so that the mold might be *eased* after the casting was poured, to permit contraction. With a normal contraction of 1¼ inches in diameter, it is apparent that precautionary measures are necessary to prevent the casting from cracking. Layers of straw between courses of brick in the branches furnished the necessary elasticity in these sections of the mold.

The core was built first. A level bed was swept for the reception of the core plate and then the outside of the mold was built up flush with the plate and a thickness of loam was swept on for a seat for the lower flange segments. The lower part of the core then was built, fol-

lowed by the seats for the two branches on opposite sides. The remainder of the core was built with a sweep for the circular part and a skeleton frame for the two branches.

After the loam on the core had stiffened, lagging strips corresponding to the desired thickness of metal in the casting were erected in position all around so that the core was totally enclosed. The various ribs, flanges and bosses were tacked in place by measurement and then the outside wall of the mold was built up to a point level with the top of the branches. For security and strength this wall was carried in a rough circle back of the branches. Sand was rammed between the wall and the steel curbing with layers of coke connected by upright passages at several points to facilitate the drying of the mold and later to provide a passage for gas.

A drawback plate suitably provided with rods and dabbers was placed over each branch and bricked up to the required height. A wood segment, 3 feet in length, was used for a guide in forming the open ring on top of the mold, that is the continuation of the flange. The drawbacks were removed first. Then the lagging strips, previously oiled, were taken out, thus leaving a clear space between the outer and inner walls of the mold. The core was lifted out by attaching slings to four lugs on the inside of the core foundation plate. The core was placed on one of the core-oven cars where it was finished and blacked and then run into the oven for a thorough drying.

The drawbacks were returned to place and a short sweep was employed to true the circle and apply a finishing coat of loam. The inside of the mold was finished and blacked in the usual manner and then dried with a couple of salamander coke fires. Afterward, the drawbacks were removed temporarily so that the main core might be lowered into place. Then they were returned to place permanently. The core and drawbacks were weighted down and after the runner basins were made up the iron was poured into the mold from two ladles on opposite sides. The mixture contained 15 per cent steel scrap and the analysis of the iron in the casting showed silicon 2.00 per cent, sulphur 0.10 per cent, phosphorus 0.40 per cent, manganese 0.70 per cent.

T. M. Manley, associated with the Morse Chain Co., Ithaca, N. Y., for 20 years, has been appointed a district manager in the East, with his headquarters at the home office.

Gray Iron Conference Is Approved

Gray iron foundrymen of the Philadelphia district have decided to send a delegation to a meeting to be held at Pittsburgh on March 13 to discuss research and improving business practices in the gray iron castings industry. This plan supplants the original intention to hold such a meeting on that date in Philadelphia.

The decision to send a delegation to Pittsburgh, said B. H. Johnson, chairman of the gray iron research committee of the Philadelphia Foundrymen's association, before a meeting of that association Feb. 8, was reached after his committee had conferred, on the day previous, with a delegation representing the gray iron foundrymen of the west.

"At the time the Philadelphia Foundrymen's association, on Jan. 16, sent out a letter inviting gray iron foundrymen of the country to send delegates to a gray iron meeting to be held here on March 13," said Mr. Johnson, "plans were actively under way for launching a similar movement in the west. As a result, Walter Seelbach, of theForest City-Walworth Run Foundries, and Dan M. Avey, editor of THE FOUNDRY, came to discuss the matter with our committee.

"After going over the entire matter, the Philadelphia foundrymen gladly consented to abandon their plan for a meeting here on March 13, and have agreed to send their committee to attend a meeting which will be held at Pittsburgh on the same date to discuss the subject of research and other work to promote the interests of the gray iron foundries. We were glad to accede to the suggestion that the meeting be held at Pittsburgh, for the reason that Pittsburgh is an overnight ride from the principal foundry centers of the country and it was thought that the selection of this location might prove more convenient to a greater number of foundrymen."

Mr. Johnson, chairman of the gray iron research committee of the Philadelphia Foundrymen's association, is works manager of the Cresson-Morris Co., Philadelphia. Other members of the Philadelphia committee are J. A. Davies, general superintendent, Westinghouse Electric & Mfg. Co., South Philadelphia, and W. B. Coleman, of W. B. Coleman & Co., Philadelphia. This is the committee which will go to Pittsburgh for the meeting of March 13.

Dr. Richard Moldenke was the principal speaker of the evening. He told of observations made at foundries in Germany and Sweden during his recent trip abroad. He particularly stressed the quality of pig iron. The extent to which the iron has been oxidized in the blast furnace, he said, determines if it is good or bad.

He told of so-called high-test gray iron encountered in Europe. This iron is brought up to an extremely high temperature in the melting furnace, around 3000 degrees Fahr., which is sufficiently high to drive out all traces of oxygen. Then the iron is allowed to stand until it is quite cool. When this iron freezes, he said, it does so suddenly and the carbon does not have a chance to crystallize. Such carbon as is to be seen in this iron is shown by microphotographs to be uniformly distributed throughout the mass in the form of minute nuclei. Because of the freedom from oxides and because the carbon is kept largely in solution, this iron possesses unusual strength.

Germany is producing pipe in longer lengths, he said. He saw pipe nearly 25 feet long. He also was impressed by the pouring of pipe direct from the blast furnace.

He said that much progress has been made in annealing box mixtures in Germany. Annealing boxes containing 17 per cent iron, 50 per cent nickel and 33 per cent chrome, are giving two to five years of continuous service.

He told about a novel device which he saw on a cupola. By means of a timing device, each one of 10 tuyeres around the cupola is closed in turn. At the expiration of about three minutes, this tuyere is reopened and another one closed, this keeping on continuously. Dr. Moldenke said the intention is to keep the tuyeres free from slag, and the cupola operating efficiently. He believes the idea worth investigation on the part of operators of continuous cupolas in the United States.

Dr. Moldenke described a method of charging ferrosilicon and ferromanganese in the cupola in Germany. The lumps of these metals are covered with a layer of Portland cement which is hardened in a core oven. After they have been thoroughly dried and hardened, they are charged into the cupola and go down to the melting zone without even cracking. The alloy metals are carried intact to the molten mixtures. As a result, it is said to be easier to get any desired analysis.

Charles H. Leinert, president of the Leinert Valve Co. Inc., with offices at 310 South Michigan Ave., Chicago, has been appointed district representative in the Chicago District for the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

Cleaning Room Progress Aids Production of Quality Castings

By Frank G. Steine[illegible]

Part II

THE first tumbling mills used to clean the sand from castings in American foundries were made in the hexagonal and the round forms, of either wood or iron. The simple machine consisted of a cylindrical shaped vessel built of wooden slats or perforated metal slats. The slats were bolted to the two end pieces or heads. Some of the early types also were made in the shape of a barrel. On one type, the barrels or drums rested on four friction rollers which were mounted on shafts that ran in heavy bearings. The shafts were driven by spur gears or friction wheels. Another type of tumbler had a trunnion bolted to each head. The trunnion was supported by a cast frame and the tumbler was driven through a pulley attached to the trunnion on one end or through friction gears. In some cases two barrels were mounted on one frame and were driven by friction wheels mounted between the barrels. Still another type of tumbler was driven by a chain operating over a sprocket mounted on one head of the barrel. A barrel introduced during the period was built egg-shaped of heavy steel and lined with replaceable hard iron linings. It was claimed that a double action was secured with this machine, the castings moving from the ends to the center and from the sides to the center.

At first, cinder or slag was placed in the barrel to aid in the cleaning process and later, hard-iron shot and small stars also were introduced for that purpose. As the sand and dirt was knocked from the castings, it escaped through the perforations in the metal slats or between the wooden slats. The escaping dust and dirt made the cleaning room an exceedingly dirty and disagreeable place in which to work and soon led to the introduction of equipment for conveying the dirt and dust from the room.

Air was exhausted through a hollow shaft at the ends of the barrel and clean air was drawn through openings between the staves, or when a steel drum was used, through perforations in the head opposite the hollow shaft. The hollow shaft or pipe was connected with an exhaust fan and had a dust box in the line. The dust box was provided with a deflector plate which caused the dust to drop into a water bath at the bottom of the box as is shown in Fig. 3. Dust was removed at the opening shown near the bottom of the box. Adoption of the system for collecting dust in the cleaning room was one of the first attempts made to improve working conditions in the foundry. Not only was it of great value from the humanitarian standpoint, but it enabled the men to do more and better work.

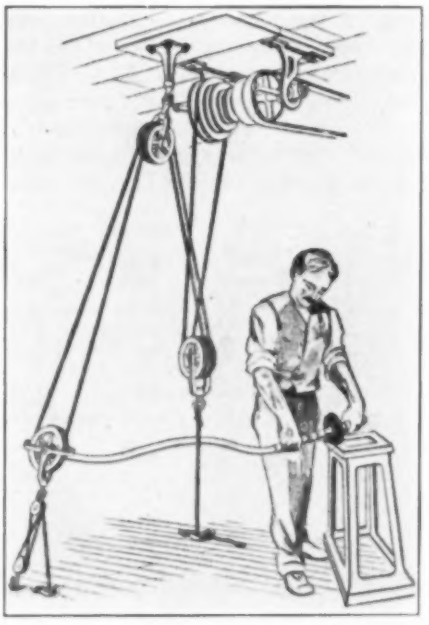


FIG. 2—AN EARLY TYPE OF FLEXIBLE SHAFT GRINDER

A water mill also was used at about the same time to polish small castings. Water mills usually were made in the cylindrical form with a hole through which the castings were placed in the barrel. The hole was closed with a special water-tight cover. Before the hole was closed, water was placed in the mill with sandstone spalls or small pieces of granite. Another form of mill was made of two pieces united at the center and was shaped like an egg. This barrel was not watertight, but was run in a tub of water and the water entered the barrel through crevices at the center.

The method of removing the sand and scale from castings by the application of an acid, commonly known as pickling, probably was first used in foundries sometime after the introduction of the tumbling barrel. While sulphuric acid, which first was used in the pickling process, was produced on a commercial scale in England in 1746, and was used to pickle charcoal-iron tin plates in 1806, it is believed that it was not used in the foundry until considerably after the latter date. Demands made by the machine shop largely were responsible for the widespread use of this method for a number of years.

Tool steel used on the various types of metalworking machines during the latter part of the nineteenth century was not of the high quality manufactured today. High-speed steel was not known widely. Machinists encountered considerable difficulty in maintaining a cutting edge on tools, due to the grinding action produced

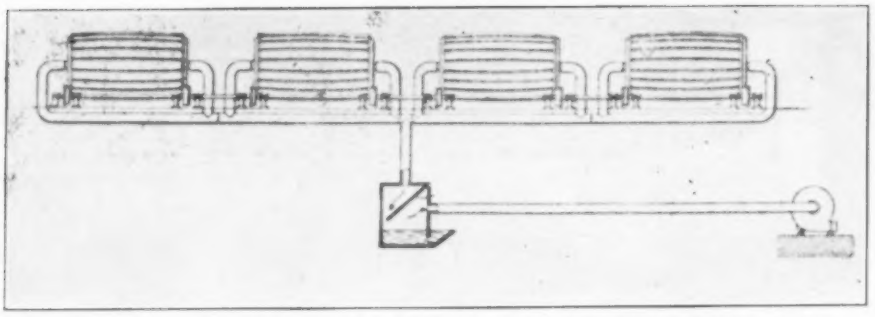


FIG. 3—DUST, STRIKING THE PLATE DROPPED INTO THE WATER BATH

by the sand and the scale of iron oxide on the castings. Many machinists demanded castings that had been cleaned by pickling, since they believed that method removed all of the scale.

Several different kinds of acids were used for pickling, sulphuric acid (oil of vitriol) probably being the most common at first. Hydrochloric and nitric acids also were used and a little later hydrofluoric acid came into general use for certain classes of castings. While sulphuric acid held an advantage in that it was cheap and relatively easy to manipulate, the acid dissolved the iron rather than the sand scale. Hydrofluoric acid had the advantage of dissolving the sand and the scale and not the iron.

Two methods were used in applying the acid to the castings. In one method, the castings were suspended in a tank filled with the acid. In the other method, the castings were laid on a series of perforated, inclined, wooden shelves. The fluid was poured over the top and allowed to trickle down over the castings on all of the shelves and then back into the vat. This process usually was continued by the night watchman or some other person in the plant and in the morning the castings were washed down with a hose or immersed in a hot solution of soda or potash to neutralize any remaining acid.

Grinding Is Introduced

While foundrymen long had used pieces of emery, sandstone and other abrasive materials to rub the sand from the castings, it was not until around 1870 that the emery wheel was introduced into the foundry. The first solid grinding wheel was made about 1867, using a vulcanized rubber bond. These wheels were supplied to the consumer without being trued or fitted in any way. Other methods of bonding the wheels were developed in the following years. In 1878, a wheel broke in the grinding room of a Detroit brass shop and killed the son of the proprietor. This accident led to the adoption of a number of safety features, such as using a wire web in the wheel and having guards over the wheels which protected the operators.

Grinding was developed as an aid to the foundry industry in the face of considerable opposition. Practically no care was exercised by many in buying and placing grinding machines, and as a result machines were not adapted to the particular work for which they were being used. In many cases, through a lack of knowledge on the part of the worker, the machines were operated improperly. However, this condition changed rapidly. The first grinder was the stationary stand type. This grinder was entirely satisfactory for removing fins and other projections on small castings which could be lifted and held against the wheel, but could not be used on larger work. This led to the introduction of the flexible shaft grinder and the swing frame grinder. The first flexible shaft grinder was a rather awkward tool, as shown in Fig. 2, due to the pulleys and rope belting used to secure sufficient flexibility. The swing frame grinder was a rather crude affair at first, but it was built upon the same general principle as the modern grinders of that type.

The earliest sandblast and the application of a combined jet of air and sand for the purpose of cleaning castings was made in 1870, when the process was invented by B. C. Tilghman. While sandblasting found early favor among various foundries in Europe, the process made slow progress in America for the first 25 years, due to prejudice. Most of the early developments in automatic types of sandblast apparatus and the rotary table semiautomatic sandblast machines were made in Europe. In the earlier forms and many of the later types of the sandblast machine the sand was propelled by a jet of air striking it as it trickled down from an overhead sand tank, and the whole admixture and mingling of the air and sand took place in the delivery hose, which necessarily was of large diameter. Later, a machine was designed with a special mixing chamber into which the air was admitted progressively through three jets, each supplementing the other. This device permitted a thorough mixing of the air and sand, which then passed at a high velocity through a delivery hose of moderate diameter.

Compressed Air Needed

An early objection to the installation of sandblast equipment was the expense of the equipment and the necessity of supplying compressed air for the machine. However, as the years passed, various pneumatic tools were developed which were of great value in cutting foundry production costs. Chipping tools, rammers, sand sifters, hoists and molding machines, all operated pneumatically, quickly were adopted in the foundry and the air compressor soon became a necessary piece of equipment in the up-to-date shop. Undoubtedly the development of these other types of pneumatic tools furthered greatly the cause of sandblasting, since with little added cost the foundryman could install compressors having a sufficient capacity to meet the needs of the sandblast machines.

The pneumatic chipping hammer was applied to foundry cleaning operations near the close of the century. This hammer consisted of an air cylinder with a reciprocating piston to which was attached a chuck that held

(*Concluded on Page* 190)

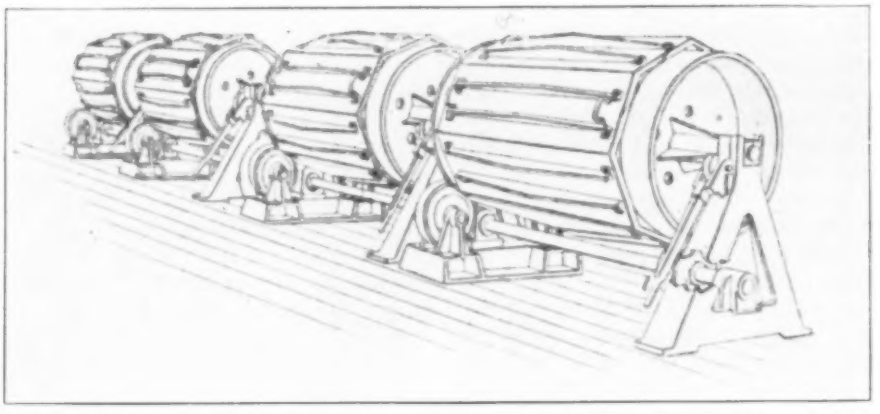


FIG. 4—NUMEROUS DRIVES, INCLUDING FRICTION WHEELS, WERE USED ON THE EARLY TYPES OF MILLS

Presents Notes on

Making Bulky Copper Castings

By W. J. Clark

COPPER is a difficult metal to cast. Its peculiarities embrace varied details. First it is set stubbornly against entering the mold in a mechanically clean condition due to its capacity to manufacture its own impurities and its ability to carry them in solution through its own peculiar fluidity. Ordinary practice will deliver a polluted molten copper mass to a mold and work the impurities to critical positions in the casting. To avoid this the metal's automatic powers must be curbed and the casting carefully protected against any invasion.

Many copper impurities as scale, dross, oxide, etc. result from the atmospheric contact. This is quite evident from the thick, granular, crusty appearance of the molten copper surface openly exposed in the ladle to the atmosphere. In extreme cases I have seen this surface form to a thin hard crust covering the entire surface. On other occasions I have noticed the surface metal take on the appearance of slush ice. A protected copper surface happily is free from these conditions and has a clear, limpid, fluid appearance.

Of those materials functioning as protective agencies to a molten metal surface I have never found any quite equal to crushed charcoal, and when working pure copper the metal gets a maximum protection of this material insofar as my jurisdiction as a molder covers the case. I have tried many surface fluxes sold under various names but have never found any I could conscientiously consider on a par with this comparatively inexpensive charcoal covering. To metallurgists charcoal is known as a neutral flux, one which does not enter the metal nor change its natural properties. It has only the power to work on the metal surface to reduce its scale and dross and protect it against their recurrence. This it evidently does in its burning or consumption and after once burned to ashes loses that power. The mere fact of covering a copper surface with charcoal as the metal leaves the furnace is therefore not necessarily a guarantee of adequate protection. If that covering burns to ashes before the metal is poured, it ceases to function and a fresh layer of charcoal must be added.

The extent to which I value charcoal is indicated by the method I always observe in pouring the heavier copper castings. This method is the drop pouring idea in which the runner box with the plugged bottom-hole is used. Before pouring the metal into the runner box I put a good shovelful of charcoal in the runner box bottom and pour the metal over it after which the stopper core is lifted. The charcoal of course, floats to the metal surface and forms a protective covering throughout pouring. I have found this a substantial advantage in making bulky copper castings. The benefits of the process are that the clean bottom metal of the runner box is the metal run into the casting and the bettering influence of the charcoal on the metal poured on it as well as the surface protection accorded by the charcoal.

Another important detail of clean casting metal is the manner of gating the casting for its running. Some method or system of skim gating is absolutely essential and the greater the pains in this particular the better the chances for a clean casting. There are many types of skim gates. One common form is the thin choking gate section occuring somewhere in the channel. My method in gating heavy copper castings almost universally is to gate and pour through a gate intended only for this purpose and do my feeding through a riser or risers

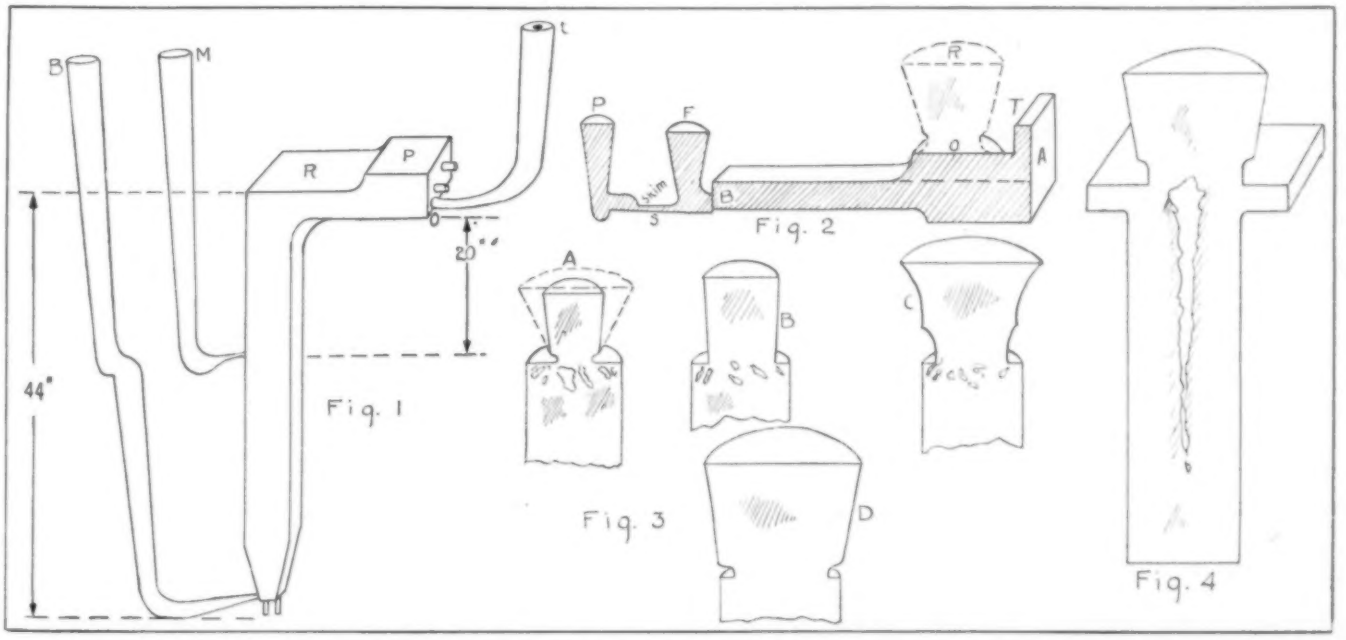


FIG. 1—SHOWING THE METHOD OF GATING A DEEP MOLD FOR A COPPER CASTING. FIG. 2—ON COPPER CASTING, RISERS AT *O* AND *T* ARE NECESSARY TO GUARD AGAINST SHRINKAGE. FIG. 3—METHODS OF INCORRECTLY AND CORRECTLY RISERING COPPER CASTINGS. FIG. 4—AN EXAMPLE OF PIPING UNDER A RISER

quite independent of the pouring channels. With this in mind I cut my thin gates from the main runner to the casting and do the choking at that point. This allows live active metal close to the casting and full gates throughout pouring. Of course the choking gate section may occur anywhere along the runner's course but not to the same advantage as when close to the casting. I have found it still further conducive to clean metal to gate heavy copper castings at the bottom rather than the top of a deep mold. This gives the metal a less rapid inflowing current as the mold fills as well as a choking effect in the sprue itself. An important detail of pouring copper castings is to keep the pouring gate always full and choked. This excludes much dross and scale from the gates and relieves the pouring head and sprue walls from the direct action of the metal falling from the ladle. Allowing the pouring gate metal to fall after once being filled is an invitation for dirty copper castings.

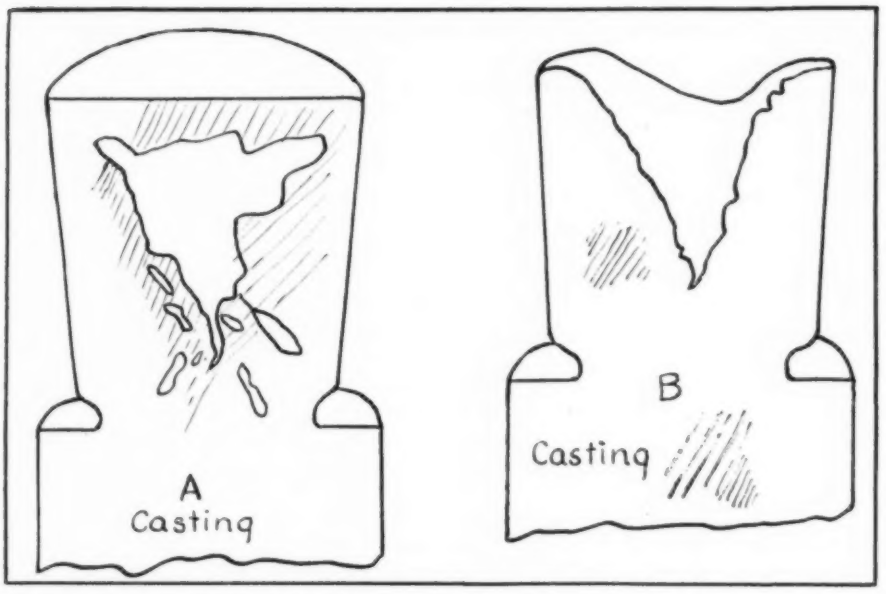


FIG. 5—*A*—RISER SURFACE EXPOSED TO ATMOSPHERE. *B*—EFFECT OF COVERING SURFACE WITH CHARCOAL IMMEDIATELY AFTER POURING IS FINISHED

Another important factor of properly running a heavy copper casting is a correct pouring rate, that is an inflow of current in keeping with the proper running demands. If the skim gate is too small the mold fills too slowly and may either misrun or sectionally include metal too cold for the guarantee of solidity. Against this the skim gate must be dimensioned correctly and it will be found best either to widen the skim gate rather than deepen it or to resort to a number rather than a single skimming gate from the runner to the casting. A broad thin skim gate or a number of such gates will skim clean and seldom draw from the casting in cooling. A narrower and deeper skim of the same volume may result both in poor skimming and drawing conditions.

In extremely deep or heavy castings, bottom poured, a disadvantage always is that the top metal of the filled mold is colder than the bottom which is the improper order. Against this it is often good practice to *double pour* such molds both at the bottom and near the top. The near-top pouring starting after the bottom pouring has raised the metal slightly above the level of the near-top, entering gate. In extreme cases I have gone so far as to pour from bottom near-middle and near-top positions. One such case was a large copper welding arm containing cast-in pipes for water cooling circulation. The method is shown in Fig. 1 and is practically self-explanatory of the wisdom of the triple pouring.

The second outstanding feature in making bulky copper castings is shrinkage and the unusual difficulty of adequately feeding against it. The main factor of this feeding difficulty seems to be that no volume of feed or supply will carry far into the casting before it loses its fluidity for some reason or another. This in connection with the high loss from shrinkage native to the metal, makes the situation often treacherous. It renders a hard condition difficult to get to.

An example of this peculiarity can be studied from Fig. 2. In the ordinary metal or alloy, if the casting be gated heavily with a good feed sprue back of it at point *A* this gate will hold the heavy end section against shrinkage to the casting's highest point. In copper the likelihood would be a heavy shrinkage locating under both *T* and *O*. Against if a riser be placed over *O*—*T* likely will suffer an appreciable loss in copper that would not materialize in the ordinary alloy. A further contrast is that a riser or a gate satisfactory to the ordinary alloy would be found far inadequate for a copper casting. From these observations follows the general rule for feeding copper. Feed heavily at all heavy and high points in the casting to guard against shrinkage.

In every feeding reservoir on a casting two conditions are absolutely essential to a proper functioning. First, the fluidity of the feed must outlast that of the part of the casting fed and second, communication between the reservoir and the fed section must be kept fully open until it is set completely. These principles apply to all metals and all alloys under any and all conditions and in the argument of perfect results are inviolate. The only difference in shrinkage between any one metal or alloy and any other is simply a matter of degree and distribution according to the natural and inherent tendency of each.

Shrinkage Is Variable Quantity

The contention sometimes made that some metals and alloys in heavy or variable bulk require no feeding because they do not contract or shrink in cooling is absurd. It is just as rational to say that heat expands some metals but not all metals, and that is a known absurdity. However, it is true that some metals and alloys shrink more and distribute their shrinkage losses more harmfully than others and among these is copper. It definitely can be said of this metal that its volumes of loss from shrinkage are extremely high while its ability for distributing that loss is signally harmful and troublesome. It will form piping cavities more perhaps than any other common nonferrous metal or alloy.

This tendency appears in Fig. 4 and shows how the casting poured on end and fed with a riser on the top piped more than half-way down directly under the riser. In this case the riser either contained an inadequate compensating volume or failed to follow up the loss in its outward and downward development. This may occur from the riser having insufficient volume, from the riser neck being too long, from the riser surface over the casting being too small, from a comparatively low temperature of the riser metal forcing it to solidify before the casting metal is completely set, or from any number of causes.

A study of riser shortcomings and effects on copper is given in Fig. 3. In example *A* the riser is undersurfaced at the casting and even though the reservoir were enlarged to the dotted lines, its communication with the casting would cease as the riser neck congealed and allowed the still liquid metal in the casting to shrink unfed. In *B* the reservoir is not the proper shape to keep the freezing metal long liquid over its communicating surface and a consequence similar to that in *A* ensues. In *C* the reservoir is ample and the surface covered sufficient, but the neck is too long which deprives the metal in it the full benefit of the upper supply in keeping it hot and active. In *D* the correct method is illustrated; the surface covered the riser supply and the communicating neck all shape up to practical common sense. Incidentally these examples all are representative of actual foundry experience in copper.

Cites Best Form

In any feeding reservoir, the tenure of fluidity over that of the casting depends mainly on three conditions: Form, volume and temperature. All molders know that certain forms of metal solidify more rapidly than other forms; a long bar for instance as against a cube of equal volume. They may know also that of all others the roundest is the most practical form to lose its heat least rapidly. Volume and temperature affect the freezing time because of their greater quantitative values of heat, the one from bulk, the other from degree.

Now in copper, peculiarly given to freezing obstructions, it is important that the feeding reserve be kept actively fluid throughout the setting period to deliver a readily available supply for every particle of loss. To this end the riser should be constructed as previously indicated and whenever possible should be given hot metal direct from the ladle to complete its filling. In the great majority of instances, metal rising from a mold into a riser is in no fit condition to feed the casting. When the condition is unescapable, the form and volume of the riser metal must be such as to adjust the temperature discrepancy.

The height of a riser is another important consideration in feeding copper. If it be too low regardless of its lateral bulk, it will lack the necessary pressure to force the supply solidly into the vacancy.

If you watch riser metal come to rest from a copper mold and lie openly exposed you will soon see the same condition develop as on the bare surface of the metal in a ladle, a thin crust of solidifying metal over the entire riser surface. This crust deepens rapidly, chilling its under bath and taking from it a quantity of metal to compensate the crust shrinkage loss. The development is so rapid and complete that often the bulkiest risers show no sinking whatever, instead a perfectly level top surface. By breaking this thick surface crust the effect as shown in Fig. 5 is seen at once and the result easily is gaged. The riser simply had to feed the congealing crust and deny the casting indirectly to the extent of this loss.

Atmospheric influence again is responsible for the crust and if the liquid riser surface be covered at once with a crushed charcoal the condition disappears. This is one of the never neglected means I employ to get proper feeding in a copper casting riser and the result is excellent. Risers so treated keep a liquid surface up to the last and shrink and feed admirably. However, the result must not be considered due to the *supplied heat* of the charcoal but rather to its protecting and reducing powers since the heat supplied by the charcoal is practically negligible in prolonging the metal fluidity.

A peculiarity of copper that affects its shrinkage seems to be its fast freezing rate around its exposed surfaces. This extracts a heavy toll of riser supply to these fast freezing zones and frequently results in cleavage leading from the outside edges of the riser into the casting. The rational assumption is that this riser supply cannot get to these fast freezing zones because of freezing obstructions in these same zones as well as in the exposed surfaces of the riser itself.

This results in a pull and the eventual cleavage so common to the copper riser. Fig. 7 illustrates the difficulty and suggests the two-featured remedy as indicated by the dotted lines. Make the riser attaching surface full and plenty, at least 80 per cent of the casting surface involved, and keep the riser neck short to get the full benefit of the heavy reservoir supply immediately above it. A long neck riser on a copper casting can do irreparable damage around its exposed surface in the casting.

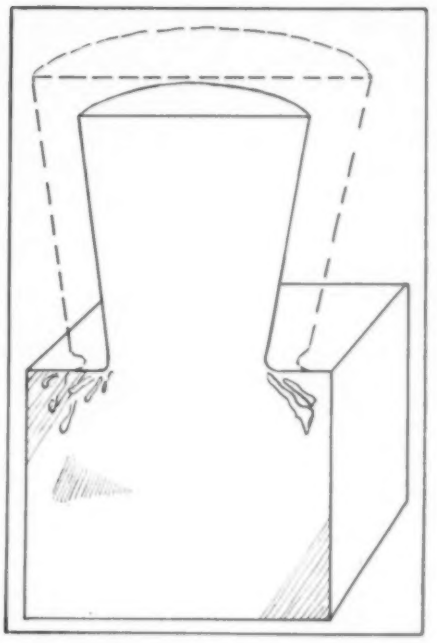


FIG. 7—INCREASING RISER DIMENSIONS WILL PREVENT CLEAVAGE

Fig. 6 represents another condition under which the treachery of copper shrinkage asserts itself, two bulk equals or variables connected by a lighter than either casting section. The bulk at *B* without a riser feed pulled through the narrow neck *A* in the casting from directly under the riser edge at *R* and left the casting with its shrink cavity as outlined. To adjust the matter an additional feed was used at *B* as shown by the dotted line.

A further example of the limited scope of a feeding riser on copper will appear in a square bar 36 inches long by 8-inch square section, molded flat. A heavy riser on either end of such a casting could not be trusted to eliminate shrinkage throughout.

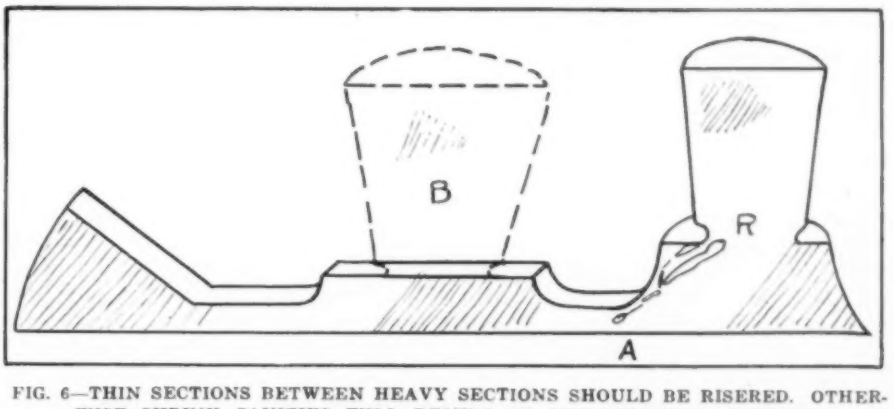


FIG. 6—THIN SECTIONS BETWEEN HEAVY SECTIONS SHOULD BE RISERED. OTHERWISE SHRINK CAVITIES WILL RESULT IN THE HEAVIER PORTIONS

Four good risers equally spaced were required to get satisfactory results.

The foregoing are a few of the many instances when the different sizes and shapes of castings call forth different methods and pains in their feeding. This is generally true in all metals and alloys. In copper it is especially true by virtue of the more critical peculiarities of copper previously mentioned.

With the delivery of clean well skimmed metal to the mold and the problem of feed cared for, the molder's responsibility practically ceases for the bulky copper casting. However, two additional factors remain in which he might be interested. The metal condition in general and its pouring temperature.

The hardest task in copper is to get the metal chemically fit to produce a sound casting. The subject here becomes metallurgical rather than practical and naturally is beyond me to discuss intelligently. From what I gather, the trouble is mainly oxides and gases in the liquid metal. As the metal cools these gases escape and give that honeycombed effect which is shown in thousands of worthless copper castings. An indication of the activity of these gases is shown by the gate which swells up instead of shrinking down in the head. Sometimes the metal while yet liquid will flow back out of the mold through the gate after the pouring has been finished. In either case the casting may be scrapped promptly.

Pouring Temperature Is Factor

Two factors appear to figure in the condition; melting practice and the addition of reducing elements in the metal. The best melting practice I ever have seen has been that which melted under the charcoal protection brought the metal to the proper temperature and poured it immediately thereafter. As to the proper pouring temperature time was when I thought that the lower temperatures were less dangerous. On this I have changed my mind considerably and now I would not pour a bulky copper casting as cold as I have poured them in former years under any consideration. When the metal has been melted properly, protected and treated, the medium temperatures at pouring are to my mind far better than the extreme ones either way.

Reducing elements often are added to copper and I have seen silicon, magnesium, zinc and phosphorus resorted to at different times. I also have molded for copper treated with boron sub-oxide. Of all remedies I believe I have noticed best results when a small percentage of zinc along with just a pinch of phosphorus was used, the zinc approximating 2 per cent. High electrical conductivity is often a required condition for a copper casting. The zinc and phosphorus make for soundness but are said to interfere with conductivity. For this reason I have cast copper where no zinc or phosphorus was allowed and silicon, magnesium or boron sub-oxide was used to give fluidity. These elements are said to be less meddlesome with conductivity. On that I cannot write but am free to say that as far as dependability for clean sound metal is concerned I never found any of them I consider as trustworthy as the zinc-phosphorus method. With regard to conductivity I often have thought that a porous copper casting regardless of its copper purity might express a lower conductivity than a sound casting embodying copper and a trace of other elements. At any rate I have made large bulky copper castings requiring high conductivity where the zinc-phosphorus additions were made. Clean solid castings were obtained and no objections were heard.

Considers Variations in Iron Qualities

(*Concluded from Page* 175)

same compound composition and retains, therefore, to a greater or less extent, its original properties. The theory advanced in this paper does not attempt to ascribe all the properties of the iron to the compounds which may be present. The alloy structure is most important. There are other things, however, besides what might be called the gross structure which may profoundly influence properties. It is suggested that as in the ordinary processes of manufacture, there are variable factors which greatly change the compound composition, that possibly this may account for observed differences in pig iron qualities.

The author is using the theory tentatively to outline experimental work and is not so committed to it that the results of this experimental work may not cause him to throw it overboard or to modify it considerably, but as a working tool it seems to have some use.

George P. Coulter, 4484 Cass avenue, Detroit, has been appointed exclusive agent in Michigan for the Standard Sand & Machine Co., Cleveland. Mr. Coulter has been identified with the foundry equipment field in Michigan for ten years.

Radiator Top Cuts from Pencil Runners

Question: We pour our hot air radiator sections through a ring of pop gates on the top and we find that occasionally that the sand on top of the core cuts away. Can you suggest any material which we can spray on the surface to protect the sand? We use a No. 2 Albany sand worked on the dry side and well vented.

Answer: The usual method of pouring these radiator rings is to cut a number of flat gates in each of the four corners of the flask and pour the metal *four-up*. The pattern is molded entirely below the joint so that the iron readily runs down one side and up the opposite side of the core, which is suspended from the cope. You do not state why you are molding the ring with the arch entirely in the cope, but we assume the principal reason is so that one ladle may be employed to pour it through a ring of pencil gates. With proper precautions this type of gate should work satisfactorily. Nearly all kinds of hollow ware are poured on top of the green sand core, either through small round pop gates or through thin wedge gates. The sand you are using is a suitable grade, therefore your trouble may be due to any one of three possible causes. Too much old, burned sand which reduced the bond; sand rammed too soft; sand rammed too hard.

In the event that either of the first two conditions prevails the trouble is due to erosion, that is the sand grains are washed away by the stream of iron. In the third instance where the sand is rammed too hard the imprisoned steam forces flakes off the surface. Ususually it is difficult to determine which cause actually is responsible.

Spraying the mold at best is only a remedial measure and you will derive greater satisfaction from discovering the exact cause of the trouble and then applying the proper preventative. In the meantime and while you are experimenting you may derive relief by spraying the mold with kerosene or gasoline containing a little plumbago. This specific prevents slightly hard faced molds from cutting or scabbing. A thin spray of molasses water or of any other core binder will help to maintain an unbroken skin on the face of a mold.

H. M. Davison, with the Hayward Co., New York, for a number of years and for the past seven years general manager of sales, has severed his connection with that company.

Must Select Refractories on Service Test Basis

WORTHWHILE information serviceable to the consumer of firebrick is not provided by the present laboratory tests according to opinions expressed at the annual convention of the refractories division of the American Ceramic society which was held at Atlantic City, N. J., from Feb. 6 to 8. This subject was opened by C. P. Spangler, Jones & Laughlin Steel Corp., Pittsburgh, in one of the informal discussions. Laboratory methods of testing firebrick for checkerwork in open-hearth regenerators are practically worthless from the consumer's viewpoint according to Mr. Spangler, and he stated that the consumer must make a service test of his own. His method is to place a few submitted bricks on the bridge wall of an open-hearth furnace and observe their reaction through a peep hole. If this rough test shows merit, several hundred brick are laid up in the checkerwork and this will determine the fitness of the brick for the conditions encountered. Mr. Spangler also suggested that furnace flames be analyzed so that it might be possible to establish typical flames, and study the behavior of refractories in contact with the different types of flames.

F. A. Harvey, Harbison-Walker Refractories Co., Pittsburgh, who is a member of the refractories sub-committee of the American Society for Testing Materials directed attention to the fact that refractories which give satisfactory service in one plant often fail to meet the requirements in some other plant, and he said that those interested are seeking a test of the character mentioned by Mr. Spangler.

C. E. Bales, Ironton Firebrick Co., Ironton, O., and K. M. King, Ohio State university, Columbus, both expressed belief that it is unlikely that any laboratory test can be developed which will give reliable data on what refractories will do under different variations in service conditions. S. M. Phelps, Mellon Institute of Industrial Research, Pittsburgh, told of improvements in laboratory methods of testing firebrick but expressed the conclusion that it is very difficult to approximate actual service conditions.

One of the outstanding papers was by A. E. R. Westman, University of Illinois, Urbana, Ill., who spoke on the relative importance of sampling and measurement in ceramic research. He said that accurate results cannot be had from a few tests.

L. C. HEWITT

Meetings of the Refractories Division of the American Ceramic society at Atlantic City, Feb. 6 to 8 were conducted by its chairman, L. C. Hewitt, ceramic engineer in charge of research, Laclede-Christy Clay Products Co., St. Louis. New officers elected at the business session were: Chairman, Louis J. Trostel, chief chemist, General Refractories Co., Baltimore; vice chairman, E. H. Van Schoick, Chicago Retort & Fire Brick Co., Chicago; and secretary-treasurer, C. F. Geiger, Carborundum Co., Perth Amboy, N. J.

To get worth-while results in testing firebrick, he said, at least 25 bricks of a brand must be tested, while the percentage of accuracy increases as the number of samples is increased.

A review of the existing literature on the subject of laboratory slag tests for refractories was submitted by Robert F. Ferguson, Mellon Institute of Industrial Research, Pittsburgh. This review contained 53 references and is the most comprehensive treatise of this kind prepared.

A paper which brought forth considerable discussion dealt with the results of a study by Dr. H. K. Mitra, University of Pittsburgh, Pittsburgh, on the disintegration of blast furnace linings due to deposition of carbon from carbon monoxide.

The phenomenon of ceramic freezing received considerable attention. Such freezing frequently occurs when heat treatment of ceramic materials is interrupted by chilling, or when the temperature is held static over too long a period. The body so chilled becomes distinctly more refractory. This phenomenon gave quite a little trouble to the Standard Pyrometric Cone Co., Columbus, O., about a year ago, and Gen. Edward Orton Jr., of that company, told about the investigation which was made to determine on a solution.

Dr. H. B. Henderson, Standard Pyrometric Co., also submitted a paper on the same subject, explaining how the trouble due to freezing of cones had been attacked along different lines.

Louis J. Trostel, chief chemist, General Refractories Co., Baltimore, described the laboratory which he conducts and the methods which are employed there in connection with research work, control of production, and other activities. Mr. Trostel also reported that progress has been made in the compilation of a refractories handbook and that this work should be well advanced by next year.

It was reported that mullite brick had been giving exceptional service as refractory material in electric furnace roofs and that important installations of this character are about to be made as a result of these service tests. Sandford S. Cole, Mellon institute, Pittsburgh, spoke on variations in the softening points of refractory mortars caused by the method of preparation. He reported that a study now is under way to determine the variations resulting from the different kinds of furnaces which are employed.

M. L. Bell, General Refractories Co., Baltimore, discussed the require-

ments of firebrick, including refractoriness, load carrying ability, resistance to fluxing and resistance to spalling. He made observations on the behavior of firebrick in service.

Officers elected at the business session for the ensuing year are Louis J. Trostel, chief chemist, General Refractories Co., Baltimore, chairman; E. H. Van Schoick, Chicago Retort & Fire Brick Co., Chicago, vice chairman, and C. F. Geiger, Carborundum Co., Perth Amboy, N. J., secretary and treasurer. Mr. Trostel was born at Galion, O., in 1893 and was graduated from Ohio State university, Columbus, O. Following the war he went to the United States bureau of mines and bureau of chemistry alternating his time between Pittsburgh and Washington. In 1923 he left these positions to become chief chemist of the General Refractories Co., with laboratories at Baltimore. Mr. Trostel is secretary of the committee on refractories of the American Society for Testing Materials, a member of the research advisory committee of the American Refractories institute, and is a member of the joint committee on foundry refractories of the American Foundrymen's association and the American Ceramic society.

Readers Comment

Note—Material appearing under this head does not necessarily reflect the opinion of THE FOUNDRY or of its editors.

TO THE EDITORS:

The excellent article in THE FOUNDRY of Jan. 15, 1928, entitled "Selling Is Foundry Industry's Greatest Problem," by J. J. Seaver, contains a reference to lack of standardization of cost accounting in the foundry industry. Permit me to correct this, so far as it applies to steel foundries.

The Steel Founders' Society of America has been devoting much effort for a long period of years in promoting uniform cost finding practice in the steel foundry branch of the industry. A pamphlet containing a uniform cost system was issued recently by this organization, and sent to all steel foundries with the expectation it would be universally adopted and used.

There is perhaps greater realization at present than ever before of the necessity for the use of uniform cost finding principles by members of an industry. Consequently, this was an opportune time for the Steel Founders' Society of America again to use its efforts along this line and distribute a uniform cost system for steel foundries. The adoption and use of this cost system should be helpful in creating more intelligent competition among the members of the industry.

Yours very truly,
W. J. CORBETT,
Secretary-Manager,
Steel Founders' Society of America.

Is Not Shrinkage

TO THE EDITORS:

In the Jan. 15 issue of THE FOUNDRY I noticed on page 54 that you were asked what occurred in a valve to cause it to leak under pressure at the junction of the wall and seat.

The firm I am associated with is a manufacturer of pressure valves and fittings, and has gone carefully into this matter, as it has had and at times still has the same trouble. To begin with, the fracture at the point of leak will show a darker color than the good metal surrounding this point.

We found by examination under the microscope that this dark area at the point of leak consisted of free graphite that had been rejected from the solid solution when the metal solidified. Its structure instead of being granular and evenly distributed, was a formation of graphite in whorls disclosing a weak spot in the section of metal and a probable path for leakage.

It might be possible that this particular area of metal was the last to solidify in the casting and excess graphite was carried to this point and chilled with the last metal to solidify. This defect has been called shrinkage, but the writer believes that this term is not justified upon careful examination.

H. A. HORNER
Waynesboro, Pa.

Heads Stone Company

Herbert W. Caldwell, recently was elected president of the Cleveland Stone Co., Cleveland, succeeding the late C. W. Walters. Mr. Caldwell became connected with the company in 1886 as a bill clerk. Later he was made assistant to the president. Twenty years ago he was made manager of the grindstone department. He was made vice president in 1916, upon the resignation of George H. Worthington.

Book Review

Transaction of the American Foundrymen's Association; edited by R. E. Kennedy; cloth; 484 pages; 6 x 9 inches; published by the American Foundrymen's association, Chicago, and supplied by THE FOUNDRY, Cleveland, for $5; in London, 416-17 Caxton House, Westminster, for 25s.

The present volume, No. 35 in a series that extends back to the beginning of the association activities in 1896, contains an account of the proceedings of the thirty-first annual convention held in Chicago, June 7-9, 1927.

Besides the reports of the various committees on sands, costs, apprentices, patterns, heat treatment of ferrous metals and malleable refractories, effects of phosphorus and sulphur in steel and a symposium of expert opinions on the effect of using scrap in blast furnace operation, the volume also contains the text of 37 original papers with the discussion which followed the reading of each paper. A 10-page index and an alphabetical list of authors with the titles of their papers, add considerable value to the publication as a work of reference.

Booklet Gives Details of Crane Construction

The Harnischfeger Corp., Milwaukee, recently has issued an interesting 40-page booklet which tells the story of the construction of cranes. The first portion of the publication is devoted to general information on the crane which includes some of the safety features, shaftings, gears, bushings, bearings, and the method of lubrication. The second section gives methods of manufacturing and details of construction of the bridge. The third section provides information on trolley construction and the fourth on electrical equipment. A corduroy crane also is described and a partial list of users of cranes made by the Harnischfeger Corp. is included. The publication is well illustrated with reproductions of photographs of the testing laboratories, steel and bronze foundries, forge shop, machine shop, stock yards, fabricating department, electrical manufacturing department as well as views of the various parts of the crane.

Will Move Offices

American Brake Shoe & Foundry Co., with its affiliated companies, will establish its headquarters in the New York Central building now under construction on Park avenue, between Forty-fifth and Forty-sixth streets, New York. Affiliated with the American Brake Shoe & Foundry Co., are the American Manganese Steel Co., Southern Wheel Co., Ramapo Ajax Corp., American Malleables Co., American Forge Co., and the Manganese Steel Rail Co. All of these companies since 1903 have had their offices in the Hudson Terminal building in the downtown section of New York.

Economical Oxyacetylene Cutting Needs Intelligent Supervision

By J. L. Anderson

THE oxyacetylene welding and cutting process was introduced into this country a little more than 20 years ago, but during this short period of development the process has grown to enormous proportions. In later years it has grown by leaps and bounds until now a great number of plants are required for the production of oxygen and acetylene. In addition, large factories have been established to manufacture torches and regulators and other apparatus employed in the combustion and application of these gases in the metalworking and other industries. The process has two distinct branches, namely, welding and cutting. The latter has become most important, it being estimated that more than half of the oxygen produced in this country is used in cutting operations.

The oxyacetylene process, generally speaking, offers great opportunities for economical operation and permits manufacturing processes to be performed at considerable savings over old-time methods. However, due to lack of appreciation of the maximum economies that can be obtained wasteful practices have crept in and often are unrecognized.

We have called attention to the importance of the oxyacetylene cutting process from an oxygen consumption standpoint. Let us now consider the factors that enter into the economical application of this process.

Chemicals Were Used

Inasmuch as the cutting operation is dependent primarily on oxygen, supplied under more or less pressure, we will consider oxygen as the first and most important factor. In the early days, oxygen was produced from chemicals and as the quality of the chemicals, design of the equipment and intelligence of the operators varied, the quality of the oxygen varied accordingly. As the industry progressed, oxygen was required in greater quantities and of uniform quality. To meet these conditions, the liquefaction process was established and is a common method of production.

Rather early in the history of the process, the importance of the purity of the stream of oxygen projected through the cut became recognized. Much work has been performed in determining the economy afforded by the use of high-purity oxygen. As a matter of fact, the importance of this factor now is so universally conceded that oxygen of 99.5 per cent purity can be procured in almost every industrial center. Considerable data have been published on this subject by trade papers and the technical press and a study of this literature indicates that simple shop tests can be arranged to demonstrate the value of purity.

Next in importance is the matter of equipment or apparatus as it is usually called. The cutting process subjects the apparatus to severe conditions, and it is essential, therefore, that if economy is to be secured in its operation, careful consideration must be given to its construction and durability when purchased.

The entire equipment—torch, regulators, and hose—operates at pressures considerably higher than required in welding. The surface of the material to be cut frequently is in a very undesirable condition, be-

From a paper presented before the Philadelphia section of the American Welding society, Nov. 21. The author is manager of research, Air Reduction Sales Co., New York.

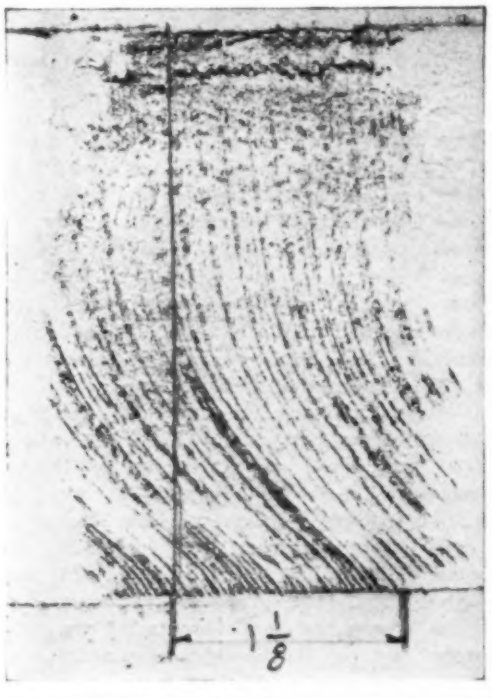
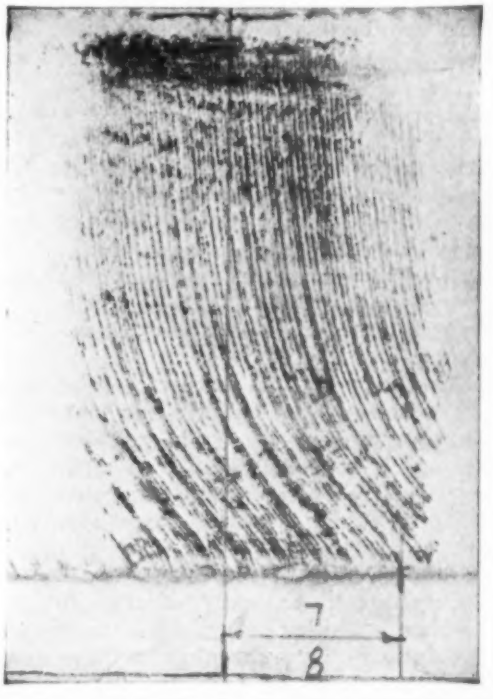


Fig. 1 (Left)—The 1⅛-inch drag of operator No. 1 ordinarily would indicate economical cutting, however, the high speed, large tip size and low oxygen pressure showed the pronounced drag to be the result of dilution or contamination of the oxygen stream until cutting practically ceased. Fig. 2 (Right)—An example of economical cutting. Operator No. 2 used a small tip and had a fine and regular drag, the top edge was sharp and the face perpendicular, denoting a narrow kerf with clear sharp cutting, affording only a slight opportunity for atmospheric dilution.



ing imbedded with burnt sand, heavily coated with rust or covered with heavy paint. Pockets and corners may be present also. All of which prolong the preheating period, deflect the heat back on the torch and operator or otherwise subject the equipment to undesirable heat conditions.

Through rough handling, such as using the torch as a pry to loosen the cut piece or as a hammer to knock off slag or to push heated sections aside, the equipment often is abused to such an extent that only the most sturdy will pay for itself before being worn out. Effective maintenance of equipment is an important factor in the economical use of the cutting process.

Sufficient equipment should be on hand so that torches, regulators, tips and hose can be withdrawn from service for repairs when necessary without interfering with plant or department operations. An inadequately equipped cutting department cannot operate economically; torches of a type suitable for the work should be provided and a range of tip sizes and styles should be on hand to meet any cutting condition that may arise.

The regulators should be of a type that are capable of passing large volumes of oxygen at pressures suitable for the heaviest cutting. The hose should be of the best quality to withstand the wear and tear to which it is subjected in work of this kind. The value of the oxygen wasted through a leaky hose in a short period will far exceed the cost of replacing the hose.

Next in importance is the factor of supervision. The oxyacetylene cutting process appears to be so simple and is so simple that it is often penalized for this reason. Its simplicity invites unintelligent supervision or perhaps the need for supervision or direction is not recognized at all. Supervision to be really effective in keeping operating costs down to a satisfactory figure requires a thorough knowledge of the oxyacetylene cutting process and its possibilities. A careful study should be made of what is required from the standpoint of quality of cut, production per hour per man, cost per ton or other unit, space required for efficient operation and other factors that seriously affect the results.

This study should lead to a consideration of equipment requirements and methods of operation and will determine the amount of supervision or direction that is necessary in order that the work may progress steadily and at a satisfactory cost. Because it is difficult to control, the human element will trouble the management more than any other one factor. While capable, industrious men always should be secured, there will be a great variation in their ideas as to those details of the process which are really important factors in economical cutting.

The individual operator should be guided in the selection of tip sizes and oxygen and acetylene pressures for the varous thicknesses and kinds of material to be cut. He should be urged to move the torch forward as rapidly as it will cut and at the same time produce a satisfactory surface. Efficient supervision will always take into consideration the ability of the operator when assigning work and will continuously strive to educate the industrious man in order that he may become a more valuable operator.

Tip sizes and the proper pressures for operation always will be specified for various thicknesses and conditions. The approximate speed also can be established within close limits as a guide for the operator. The desired quality of surface can be established and economy in oxygen consumption can be secured if sufficient attention be given these particular features. The selection of tip size and style governs, to a considerable extent, the quality of cut produced, and largely determines the pressure of oxygen and fuel gas used and the speed at which satisfactory cutting can be accomplished.

Manufacturers' tables of tip sizes can be followed rather closely with profit, but the tendency is more often to use larger sizes than those specified in the belief that by so doing faster cutting can be accomplished. As a matter of fact, faster cutting can more often be done with small suitably-sized tips for the reason that the chilling effect is minimized and there is less induction of atmospheric oxygen and nitrogen into the cutting jet to dilute and contaminate the stream of oxygen that will do the cutting.

The style of tip should be given consideration and, in general, it is safe to assume that one with multiple heating flames of small size is suitable for most cutting except when the material is covered with heavy refractory covering of rust, scale or paint, in which case larger preheating flames are desirable. The cutting tips receive severe abuse and too much care cannot be exercised in maintaining their original perfect form and condition.

Comparative Cutting Results of Seven Operators

Operator No.	Thickness, inches	Speed inches	Tip No.	Pressure, pounds per square inch	Square inches cut per cubic foot oxygen	Drag, inches	Ratio of oxygen to labor cost
1	2¾	9.45	25-4	30	7.45	1⅛	3.50
2	2¾	8.04	24-3	40	8.59	⅝	2.55
3	2¾	8.00	24-3	55	6.56	⅝	3.36
4	2¾	7.93	24-3	70	5.82	⅝	3.73
5	2¾	8.00	25-4	30	7.02	⅝	3.13
6	2¾	8.10	25-4	40	6.00	⅝	3.80
7	2¾	8.74	25-4	50	5.52	¼	4.38

Many Factors Involved

Tip sizes, pressures, speeds of cutting, and quality of cut are so closely related and have such an important bearing on economy that we will consider them in greater detail. The establishment of a correct schedule of oxygen and gas pressures for the cutting of various thicknesses and grades of material is just as important as the insistance in the use of suitable tips. In fact, the specifications for tip sizes and oxygen pressures are so closely related that it is impossible to think of one without considering the other.

We have said that the tip with the smallest cutting oxygen stream orifice which conditions permit should be used and consequently in the interest of economy we must also say that the lowest reasonable pressure of oxygen should be employed which will give satisfactory performance at economical speeds. High oxygen pressures are usually wasteful of oxygen unless the operator by experience can operate at a high enough speed to utilize the oxygen economically.

This brings us to the consideration of speed of cutting and its influence on economical operation. There can be no argument as to the influence of speed of cutting upon the cost of operation when it is recognized that with a given orifice and a constant pressure oxygen flows at a constant rate. It is important, therefore, that every effort be made to force the torch to cut at the greatest possible speed commensurate with the quality desired.

Frequently we find that speed is

thought to be the most important consideration for the attainment of economical cutting, but we need only to compare the cost of the oxygen which will pass through a tip of given size in an hour with the hourly labor cost to see that the oxygen cost is a far more important factor. As will be shown later the average ratio of oxygen cost to labor cost is 3.49 to 1, not considering overhead. It behooves us, therefore, to conserve oxygen but to the extent only that it does not penalize the operation.

We must remember that in oxygen we are dealing with an invisible power, and while we can see the sparks fly when this power is released in a cutting operation there can be a considerable portion of the oxygen wasted either through ignorance or willfulness by the combination of large tips, high pressure and insufficient speed. Let us try to remember that unless all the oxygen is brought into contact with the steel that is possible through the combined influence of stream size, pressure and speed, we are not using the oxygen cutting process efficiently.

As previously stated, laboratory tests are not required to determine the value of high-purity oxygen in cutting, and it is equally true and fortunately so that laboratory tests are not required to determine when and how economical results are obtained in shop operations. Anyone who has analyzed the phenomenon of oxygen cutting has determined that the most economical cutting is usually done where the drag lines are rather fine but regular, at no point parallel to the axis of the jet, yet nearly perpendicular to the surface at the top but curving away rather abruptly in a direction opposite to the direction of travel after one-half of the thickness of the plate has been cut, leaving both top and bottom edges of the kerf clean and fairly sharp.

Drag Line Is Indicator

As a rule, the greater the drag under these conditions the more efficiently has the oxygen been used. These conditions of drag line are applicable only for straight line work. For circular or irregular cutting, the cutting lines must approach the vertical more closely to avoid undercutting. If, however, the dimension tolerances are not too close, the same economical operation is possible.

It has become standard practice in computing cutting costs, in rating operators or in otherwise establishing values, to compare time, oxygen, fuel gas and labor cost in relation to square inches cut, considering one cut surface only. To illustrate the importance of these various factors viewed from different angles, the accompanying table gives the results obtained by seven different cutting operators working on the same grade and thickness of material. In this case, the torches were all operated mechanically and, therefore, the question of personal skill does not enter. This table will serve, therefore, to point out that greater differences may be expected in hand cutting under similar circumstances when differences such as shown can exist in mechanical operation when only the tip size, oxygen pressure, and speed are under the operator's control and no exertion is necessary other than watchfulness on the part of the operator.

Here we see the result of permitting operators to put into practice their individual ideas as to tip size, speed and oxygen pressures. Each operator worked on the same grade and thickness of material. Operator No. 1 believed in a large tip and low oxygen pressure and just as much speed as would permit uninterrupted cutting. He secured by this reasoning good economy, but his pressure was too low for the size of tip and he consequently did not secure the maximum speed and fell a little short of the economical cutting mark established by operator No. 2.

Operator No. 2 chose a No. 3 tip which is 39.4 per cent smaller in area than a No. 4 tip but used oxygen at 10 pounds per square inch more pressure than the larger tip. Under these conditions he cut at 15 per cent less speed but at 15 per cent more economy in oxygen. The fact that operator No. 2 cut 8.59 square inches per foot of oxygen and therefore did more economical cutting is further verified by the fact that in this instance his ratio of oxygen to labor cost was 2.55 to 1 as compared with operator No. 1 at 3.50 to 1. In others words, operator No. 2 selected a combination of tip size, oxygen pressure and speed that produced at an economical rate.

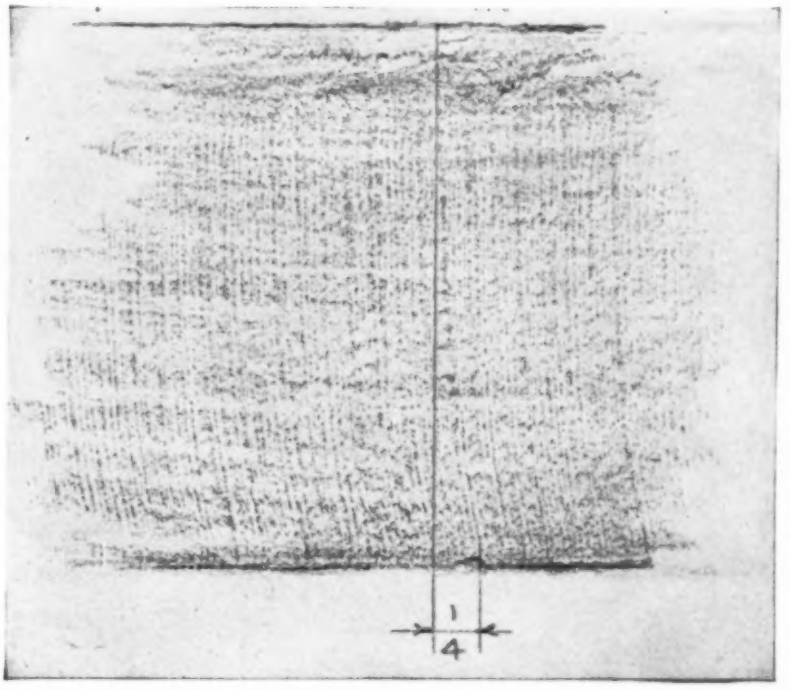


Fig. 3—Operator No. 7 favored large tips and considerably higher pressure than operator No. 1. The work proved to be unprofitable

Operator No. 5 chose the same tip size and pressure as operator No. 1, but did not work up to the capacity of that combination in speed with the result that his operations were less profitable. Now let us see what it means to go to the other extreme. Operator No. 4 favored small tips and high pressure and with a No. 3 tip, the same as operator No. 2, he increased his oxygen pressure to 70 pounds and his speed decreased slightly. The result is extremely poor economy in comparison.

Operator No. 7, who believed in large tips also believed in a considerably higher pressure than operator No. 1 and a slightly higher speed than the other operators except No. 1, but not in any sense the maximum speed for that tip size and pressure.

The result is that his work is even less profitable than that of operator No. 4.

Let us consider the work of all of these men from other angles. We have stated that simple tests could be conducted in the shop to determine the economy of the process, etc. The results in the table illustrates how the value of the men based on individual ideas and judgments can be determined. It also shows how a standard practice can be established for a particular grade of work by specifying tip sizes, styles and pressures. It shows the influence of speed on economical torch operation.

The reduction of work done to the basis of square inches cut per cubic foot of oxygen emphasizes the value of utilizing all the cutting power that exists in every foot of high-purity oxygen. Visible proof of cutting efficiency is exhibited in the appearance of the surface of every cut. This was referred to previously, but we will consider it now with reference to the results as shown in the table.

The table shows that the drag noticed in the case of operator No. 1 was 1⅛ inches as illustrated in Fig. 1, and ordinarily this would be considered as indicative of extremely economical cutting. We must, however, always take into consideration tip size and pressure in an analysis of this kind. The high speed, large tip size and low oxygen pressure would indicate that the pronounced drag was the result of dilution or contamination of the oxygen stream, to the point where cutting practically ceased. The drag in the case of operator No. 2, using a small tip, was indicative of economical cutting, the lines as shown in Fig. 2, being fine and regular, the top edge was sharp and the face perpendicular, denoting a narrow kerf with clear sharp cutting, affording only a slight opportunity for atmospheric dilution. It is interesting to note that this operator was by far the most valuable cutter from standpoint of cost ratio.

In an analysis of cutting results, we must bear in mind that as the cutting lines more nearly approach the vertical the cutting operation becomes more costly, for the reason that much unconsumed oxygen is passing out of the cut. This is emphatically borne out by the figures in the table.

The lowest possible operating cost can not be approached unless shop conditions are arranged so the men can make the best possible use of their time and keep the torches cutting practically continuously during the total working hours. The realization of this will mean that the work will be planned and laid out and instruction given in the requirements of the job so that each operator can proceed with his work with a thorough understanding of what is expected of him in the matter of production and quality.

Cleaning Room Progress Aids Production

(*Concluded from Page* 180)

a chisel. The compressed air operating the piston was supplied through a hose attached to the end of the handle. A valve operated by the thumb controlled the admission of air. Other types of pneumatic machines for cleaning operations, such as brushes and grinders, were not introduced until a number of years later.

One other cleaning process was in use early in the twentieth century. Gates and risers on steel castings were being removed with the oxyhydrogen flame. The spot on the steel casting was heated to the melting point with the oxyhydrogen flame. The hydrogen then was turned off and the pressure of the oxygen increased until about 30 atmospheres was reached. Oxygen at that pressure caused the combustion of the steel and a narrow slot rapidly was burned through the steel. Other methods of cutting the gates and risers were introduced later.

This is the second of a series of articles dealing with cleaning room equipment. The third will appear in an early issue.

Makes Personnel Changes

Several changes have been made recently in the personnel of the General Electric Co. H. F. T. Erben, assistant vice president, retired Jan. 1, after 40 years' service with the company. B. L. Delack has been appointed manager of the Schenectady, N. Y., plant and E. A. Wagner has been made manager of the Pittsfield, Mass., plant. Sales organization changes include the appointment of C. N. Gregory as manager of the New Haven, Conn., office, succeeding Frederic Cutts, and R. B. Ransom as resident agent at Hartford, Conn., succeeding Mr. Gregory.

Leeds, Tozzer & Co., Inc., 75 West St., New York, recently has been organized to act as manufacturers' representatives. Edward L. Leeds, formerly vice president and director of the Niles, Bement, Pond Co., New York, is president of the new company. Brent A. Tozzer, vice president, formerly was sales engineer of the Niles Tool Works Co., and Pratt & Whitney Co.

Care Needed in Ramming Iron Pot Molds

Question—We are making cast iron kettles in several sizes and ranging in weight from 100 to 225 pounds. When the molds are rammed soft the castings swell out of shape and are over weight. When we attempt to correct this by ramming the sand harder, the castings scab. Apparently there is no happy medium course to pursue since we have tried every method with which we are familiar. Do you know of any sand that is adapted particularly to this class of castings?

Answer: It is just possible that you are using a particularly fine, close sand which requires expert care and skill in handling and if that is the case you have a choice of two courses of action. One is to entrust the job to a man accustomed to this class of work and who instinctively will ram the sand at various points in the mold to the proper degree of density. This is a feature of the molding trade that must be learned by actual experience and one that cannot be imparted in a few brief lessons.

The second course is to secure a supply of a good grade of open sand in which molders with no particular training in hollow ware work may produce satisfactory castings. Any of the sand and supply houses advertising in THE FOUNDRY will be glad to ship you a grade of sand that will meet your requirements. Since you only require a small quantity at a time you may be able to doctor a sufficient quantity of your present sand each day to serve as facing, or you may be in a position to secure a limited quantity of good coarse sand from some shop in your city where heavy castings are made in green or dry sand molds. To secure the best result the addition of one part of seacoal and one part of sharp sand to each 12 parts of fine sand should be made in a pan mill or other form of mechanical mixer, but fairly satisfactory results may be attained in small quantities where the mixture is shoveled over thoroughly by hand. Use the vent wire liberally inside and out while the job is in the experimental stage. Instead of depending altogether on the vent wire you may find it advisable to ram a good sized block on the inside of the mold and draw it out before adjusting the bottom board.

Macnab & Co., representatives of the Tabor Mfg. Co., Philadelphia, in Great Britain, have moved into larger offices at 150 Holborn, London, E. C. 1.

The FOUNDRY Family Photograph Album

Upper Left

A. E. HOWELL

Somerville Stove Works, Somerville, N. J.

Lower Left

E. A. BALSLEY

Wheeling Mold & Foundry Co., Wheeling, W. Va.

Upper Right

WM. H. NICHOLLS

Wm. H. Nicholls Co. Inc., Brooklyn, N. Y.

Lower Right

A. J. TUSCANY

Ohio State Foundrymen's association, Cleveland

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

A LEXICON OF TECHNICAL TERMS

By O. W. Potter

(Continued from Data Sheet No. 706)

cal point is usually lower on cooling than on heating. This difference is called *hysteresis* or *gap* and is in proportion to the rate of heating and cooling (usually from 20 to 40 degrees Cent.) These critical points on heating more frequently are designated as the Ac_1, $*Ac_2$, and Ac_3 points and those on cooling Ar_3, $*Ar_2$, and Ar_1.

The A_1 (Ac and Ar) temperature corresponds on heating to the point where the ferrite and carbon form a solid solution (austenite) or the temperature on cooling where the ferrite and carbide are precipitated. At the A_2 (Ac_2 and Ar_2) temperature the ferrite in the aggregate changes in some way so as to lose its magnetism on heating and regain it again on cooling. At the A_3 (Ac_3 and Ar_3) temperature on heating the remaining ferrite enters the solid solution and forms 100 per cent solid solution and on cooling ferrite begins to separate out. These critical points are important in connection with all heat treating processes such as annealing, hardening, tempering, and metal working. See Fig. 3.

*c represents chauffage, which is French for heating.
*r represents refroidissement, which is French for cooling.

The critical range of an alloy is affected greatly by its chemical composition as is shown in the following criticals:

Pure Iron	730°C—910°C
0.20 Carbon Steel	730°C—860°C
0.40 Carbon Steel	730°C—790°C
0.90 Carbon Steel	930°C (Eutectoid comp.)
1.2 Carbon Steel	730°C—850°C
1.45 Carbon Steel	730°C—1000°C
Malleable Iron	
White Cast Iron	730°C—1130°C
Gray Cast Iron	
1% Chromium Steel	Above 740°C
1% Tungsten Steel	Above 750°C
6% Tungsten Steel	Above 760°C
3¼% Nickel Steel	Above 695°C
4% Nickel Steel	Above 693°C
5% Nickel Steel	Above 690°C

(Continued on Data Sheet No. 708)

A LEXICON OF TECHNICAL TERMS

(Continued from Data Sheet No. 707)

1.5% Nickel, 5% Chromium Steel Above 735°C
1.75% Nickel, 1% Chromium Steel Above 745°C
3% Nickel, 0.6 to 0.9% Chromium Steel Above 715°C
3.5% Nickel, 1.5% Chromium Steel Above 730°C
0.8—1.5% Chromium, 0.16 Vanadium Steel Above 765°C
13% Manganese Steel Below atmospheric temperature
25% Nickel Steel Below atmospheric temperature
(See Figure 3, Critical Range of Iron Carbon Series.)

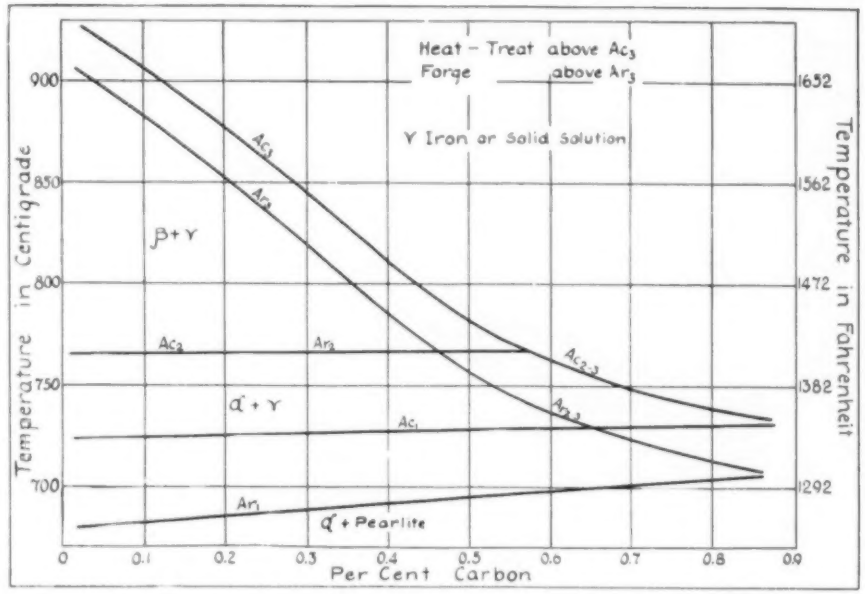


FIG. 3—CRITICAL RANGE OF CARBON STEELS

(Continued on Data Sheet No. 711)

How and Why in Brass Founding

By Charles Vickers

Gives Temperatures

We would appreciate advice regarding the most suitable temperature at which to melt and pour the following alloys: (1) *Tin* 83.34 *per cent; antimony* 8.33 *per cent; copper* 8.33 *per cent;* (2) *Tin* 50 *per cent; antimony* 15 *per cent; lead* 35 *per cent;* (3) *Tin* 7 *per cent; antimony* 18 *per cent; lead* 75 *per cent;* (4) *Tin* 2 *per cent; antimony* 12 *per cent; lead* 86 *per cent;* (5) *Copper* 87 *per cent; tin* 7 *per cent; zinc* 6 *per cent;* (6) *Copper* 76.61 *per cent; tin* 8.94 *per cent; lead* 12.93 *per cent; antimony* 0.67 *per cent; zinc* 0.85 *per cent;* (7) *Copper* 86.02 *per cent; tin* 4.16 *per cent; lead* 2.73 *per cent; antimony* 2.57 *per cent; zinc* 4.19 *per cent; iron* 0.28 *per cent. We also would like to know your opinion regarding the use of a pyrometer for this work, and what inconvenience would result from not using the same?*

Melting point of alloy No. (1) which is a standard alloy is given by authorities as 239 degrees Cent. (462.2 degrees Fahr), and its pouring temperature is given as 916 degrees Fahr. As the other formulas given are not standard alloys we can only approximate their melting and pouring tempertures as follows: (2) Melting point 185 degrees, Cent. (365 degrees Fahr.), pouring temperature 638 degrees Fahr. (3) Melting point 240 degrees Cent. (464 degrees Fahr.), pouring temperature 625 degrees Fahr. (4) Melting point 245 degrees Cent. (473.2 degrees Fahr.), pouring temperature 625 degrees Fahr.

The melting point of (5) is about 995 degrees Cent. (1825 degrees Fahr.); of (6) the melting point is about 980 degrees Cent. (1795 degrees Fahr.) and of (7) the melting point is probably a little under that of (5). The spread between the pouring point and the melting point will vary with the type of castings to be poured, so that it is not possible to give figures that can be followed closely unless the character of the castings is known, how far the molten metal has to be carried to reach the molds, and how many molds are to be poured from a carried off heat. In general there will be a spread of 100 degrees Cent. between the pouring temperature and the melting points.

The melting point of an alloy is more or less fixed. When the temperature of the furnaces reaches that point the metal softens, and becomes liquid because the heat has equalized the opposing forces of cohesion and repulsion with the result the particles of metal have no fixed position and thus glide or pass over each other. However, when at the melting point a liquid is viscous and if poured into a mold at this stage the castings either would be partially formed or if perfectly formed, would be filled with gases entrapped by the viscous liquid. This condition makes it necessary to apply more heat to lessen the force of cohesion and thus increase the fluidity of the molten material. The addition of phosphorus also will lessen the cohesion of the molecules, and an old trick of the brass founder is to add phosphorus to metals *too cold* to pour, to make it fill out the mold. However this not always is successful for often the castings are returned from the machine shop where holes are discovered.

In the case of yellow brass, aluminum is added to fluidize. However, the best way is to use heat when making alloys of metals with a copper base. In fact the alloys should be superheated in the furnace *in order* to drive apart the molecules of the different metals comprising the alloy and permit them freely and perfectly to intermingle, and at the same time render it easy for free gases to escape from the melt. If the melting is done in crucible furnaces that are comparatively slow, the metal must be protected with some substance like charcoal, but it must be a surface covering only. The charcoal must never be entangled below the surface of the molten metal, otherwise the oxides of carbon evolved, or other gases that may fill the pores of the charcoal will be taken up by the metal, and porous castings may result. In the case of rapidly-melting furnaces no covering on the metal is necessary. Therefore, the melting point is unimportant and the metal has to be heated several hundred degrees above that point. The pouring point will be important under certain conditions of molding; and it is these conditions and the type of casting that determines the proper pouring temperature for the casting.

The use of a pyrometer is a great advantage, but it will be necessary to keep it accurate, and for that reason it is always well to have two pyrometers, thus avoiding inconvenience due to the only one being out of commission. It is also advisable to determine ones own proper pouring temperatures. This requires close application at the start, but it can be done.

Gates Cause Shrinkage

We have encountered some little difficulty with the casting motor car kick plates of aluminum alloy. These castings are in the shape of a square frame with three narrow sides and one wide side, we gate them, two up, on the inside of the square, one gate connecting with the broad side and the other opposite on a narrow side. We experience trouble due to cracking. The two sides attached to the gates crack off so the castings fall into four pieces. At first we used No. 12 *aluminum alloy, making it with the hardener. Recently we have omitted the hardener and the castings do not crack so badly but the polishing time is atrocious. We have no pyrometer so have to guess the pouring temperature of the alloy. Can you advise us how to avoid such troubles?*

The method of gating is at fault and causes the cracking. Two gates keep their respective sides from congealing as rapidly as the two thin sides. Therefore, the latter solidify and shrink from the gated sides.

We suggest running the castings with one sprue located outside the square and gated to that thin side exactly opposite the broad side. Use a thin flat runner with three gates; one at each corner, and one in the center of the side; another flat runner should be carried right across the inside of the square, one end being opposite the middle gate and the other end gated into the middle of the broad side. In pouring the flask should be tilted by putting a block of wood 2 inches high under the sprue end of the flask. The liquid metal will flow down the incline narrow sides to fill the broad side first. In this operation the center runner will assist materially. Scratch vents on the joint will assist the edges of the broad side to fill out. We advise the following alloy: aluminum 90 per cent; copper 8 per cent; silicon 2 per cent.

Holds Concerted Effort Necessary in the *Gray Iron Industry*

By B. H. Johnson

THE gray iron foundry industry has been going backwards. It makes little difference whether this condition is such by comparison with other industries whose product has replaced gray iron or whether gray iron itself actually has declined in quality. The fact is that gray iron castings have been and are being replaced by other materials, and little is being done to improve the quality of gray iron or to find new uses for the metal than those for which it has been used. It is a well known fact that no business can stand still, it must either go ahead or fall behind.

It is true that methods of molding gray iron castings have been improved, perhaps in proportion to procedure in other lines of manufacture —but so also have production methods followed in making steel, malleable and nonferrous castings. Improved handling has been introduced; sands have been given study and consideration. The quality of gray iron at present is receiving much attention by certain individual concerns. The work being done by a number of firms which supply materials and equipment to gray iron foundries generally is known and is good. Certain other elements which are a part of gray iron foundry operation, such as costs, apprentice training, etc., are being studied and in some cases improvements, along the line of standardization and otherwise, have been adopted by individual foundries and groups to their advantage.

The quality of other metals has progressed and their uses have constantly increased, replacing gray iron in many cases. Some may say that this condition is inevitable due to the fact that other materials have characteristics that gray iron cannot have and qualities that are bound to cause them to replace gray iron. Perhaps this is all true. Everyone knows that steel, malleable and nonferrous castings as well as pressed steel, rolled shapes, welded products, etc. have attained uses that cannot be replaced, at any rate in the present stage of the industry. Allowing this, and considering that gray iron, as it is, cannot be expected to regain all of its lost uses, the fact remains that, while other metals have been brought to the fore by continuous improvement through alloys and other means to give increasing strength, wearing qualities, etc., gray iron has remained stationary.

Engineers, naturally, always look for materials best suited for the work in hand. Makers of metals other than gray iron, have used every effort to improve their product to meet the ever increasing demands for better quality. Makers of gray iron castings have made few attempts to improve their product, at least not until recently, and then only in isolated cases.

The statement has been made many times that "Cast iron is only cast iron, and never will be anything but cast iron." The idea, that any product never can be improved, if persisted in, is one of the things that eventually will bring failure to that product.

There are several conditions existing in the gray iron industry which show the trend of thought and why, to a certain extent, the industry has not progressed. A few gray iron foundries, in a number of districts, have endeavored to put over the idea of a uniform cost keeping system, or an improved apprentice training course. It is hard to realize what a difficult thing it is to get even a few foundrymen to see the advantages of an adequate cost keeping system, to say nothing of getting many to see any use in a uniform system. Experience with many gray iron foundrymen has shown that, while they are glad to get together socially at meetings where they hear someone talk, they do not seem willing to discuss their own problems freely. It seems that foundrymen are afraid that someone outside of their own organization will find out what they are doing, how much their work is costing, or some competitors will learn something that will enable them to underbid on certain work.

A condition like this is an indication of narrowness that will keep any industry from progressing. There are few secret methods today and

Opinions Parallel

INTEREST which has been gathering force for the past two years in the problems and perplexities of the gray iron branch of the industry again is recognized in the accompanying article, by B. H. Johnson, Cresson-Morris Co., Philadelphia. Mr. Johnson is chairman of a committee appointed by the Philadelphia Foundrymen's association to call a meeting of gray iron foundry interests for March 13 to discuss the various phases of research vital to castings manufacturers. In response to a suggestion by a mid-western committee, the place of this meeting has been removed to Pittsburgh and invitations have been sent to about 100 foundrymen and various interested organizations to attend this conference.

Mr. Johnson's remarks present some valuable points that will have consideration at this meeting.

Following on page 193 are concrete ideas upon specific phases to be considered in forming a gray iron association. This article was prepared by John L. Carter, Barlow Foundry Inc., Newark, president of the Newark Foundrymen's association. In opening its pages to these discussions THE FOUNDRY *seeks always to promote a free interchange of views, backing no group or individual, but striving always to help the industry to help itself.*

Other articles have appeared in THE FOUNDRY *from time to time upon the gray iron problem. Two, of comparatively recent publication deserve consideration. These are "Distribution Is the Greatest Gray Iron Problem," by A. J. Tuscany, which appeared on page 879 and subsequent pages in the issue of Nov. 15, 1927 and "Bring the Benefits Home," by Walter L. Seelbach, starting on page 957 of the Dec. 15, 1927 issue.*

this is especially so in the gray iron industry. Much good can be gained in any industry by getting together and comparing notes.

There are many ways by which the gray iron industry can be improved, but all ways mean that concerted effort must be made. Nothing worth while can be accomplished by individuals and little by small groups. Research may cover a wide range of activity—it is generally thought of as a study leading to improvement of the product in question. A considerable amount of work is being done to make the quality of gray iron better, notably the addition of alloying elements. Standardization of methods of cost keeping will show many foundries where they stand, what castings are costing too much and those which are over priced. More attention paid to training of apprentices, or if you please, molders and operators, is a long felt need in the industry as a whole. Publicity campaigns should be inaugurated giving true information regarding cast iron to counteract the effect of insidious propaganda for other materials; to show uses for which gray iron is the superior metal. These are but a few things that can be done to help make the gray iron industry better and increase the use of its products. But work along these lines must be done on a large scale by a large group—a national group—in order to accomplish the needed result.

The time is coming when a big concerted effort on the part of executives connected with the gray iron industry, can put this industry back where it belongs among metal products. From what has been done by individuals and single concerns, it is not difficult to see the possibilities of gray iron in the future—in the near future—if it is given half the chance that other metals have had. Research work whether it be on quality or on merchandising cannot be carried on by single foundries or by small groups of foundries. The magnitude of successful research is great and only can be handled by concerted action because only by such action can the work reach and solve the problems of the industry today.

Outlines Gray Iron Association *Objectives*

By John L. Carter

ON MARCH 13 a meeting of gray iron foundrymen will be held in Pittsburgh to discuss the formation of a national gray iron association. Delegates have been invited from many different sections of the country. The movement to form such an association has been in progress for some time, has powerful backing, has created widespread interest, and has acquired considerable momentum. Problems which vitally affect the gray iron foundries will be discussed at this meeting and important decisions may be made.

The amount of progress made will depend upon the amount of constructive thinking which has been done by the delegates before the meeting and which will be done by all during the short period that the meeting is in session. Probably only a small group of foundrymen have a clear conception of the objectives which are worth while, and the practical problems which must be solved in order to launch such an association successfully.

This article gives one viewpoint of possible objectives and practical problems to be solved and one possible solution. It is hoped that it may serve to clarify the thought of those who plan to attend the Pittsburgh meeting, so that by doing constructive thinking beforehand, they may be able to contribute more practical and valuable advice during the discussion at Pittsburgh.

It is quite generally agreed that the two most important objectives of a national gray iron association would be:

1. The preservation and extension of the market for gray iron castings.

2. The reduction of ignorant, unfair and unsound competition to a minimum.

For attaining the first objective the following methods have been proposed:

1. Research work—to improve the quality and reduce the cost of product. This is the only way that the industry can hope to hold business which has been slipping away to other industries, such as welded steel, stampings, forgings, etc., and to discover new uses for cast iron which would extend markets into new fields.

2. Advertising—To counteract propaganda which is being circulated in favor of substituting other materials for cast iron. This has been done on a national scale by associations in other industries, such as the Drop Forge institute, Sheet Steel Service bureau, etc.

3. Educational work in the merchandising of products.

To attain the second objective, the reduction of ignorant, unsound and unfair competition to a minimum, the most practical method seems to be: Educational work in foundry cost methods.

The development of a uniform cost system for gray iron foundries, and the formation of local groups of foundries that agree to use a uniform cost system are desirable. The success of local cost groups in many districts, and the great improvement in conditions which they have brought about, proves that this method of improving competitive conditions is practical and exceedingly worth while.

The results secured by national associations in other industries and by the Steel Founders' Society of America among steel foundries and the Malleable Iron Research institute among malleable foundries, make it unnecessary to present any detailed argument in favor of a gray iron association. The desirability of such an association in the gray iron field is admitted by all leading foundry executives today. The foundries cannot do these things by themselves working as separate units. They have not done them in the past, and the result has been disastrous.

Something must be done and the only way to do it is to get together and co-operate for the good of the gray iron industry as a whole. The problem is not whether or not the industry should have such an association, but how to start it and how to design it so that it will function successfully.

The members of the malleable and steel foundry associations have been asked to subscribe amounts varying from say $25 to as high as $600 or more per year. How much can be expected from the average gray iron foundry for membership in the new association?

The problem is undoubtedly more difficult in the gray iron field than among steel or malleable foundries. The average malleable or steel foundry is a larger unit, does business over a larger territory, and probably is

managed by an executive who on the average, is a higher type of business man than the gray-iron foundryman. A large percentage of gray iron foundry executives are practical men, who know more about foundry technique than they do about merchandising, costs or research. Many have not been trained in the general principles of management and the operation of a business enterprise for profit. Some have a narrow point of view—it is hard for them to look at current conditions from the standpoint of the industry as a whole.

It is no easy job to organize such men into national association and get them to put up a considerable sum of money for the benefit of the whole industry. Further, many of them are making little or no profit and are weak financially.

Can many of them be expected to put up $300 a year? No. $100? Possibly. $50? More likely. Can the maximum financial support for the program be secured by trying to include 1000 foundries at $10 apiece or 100 foundries at $100 apiece? Which plan would most benefit the industry? Shall all foundries be charged a flat rate or should the expense be apportioned on a tonnage basis? Can enough be accomplished on a $10,000 budget to make it worth while? Shall financial assistance be accepted from some other agencies or shall the gray iron foundrymen be entirely independent and self-supporting at the start? How can the proposed association best make use of assistance in its work from outside sources, such as the department of commerce, bureau of standards, American Foundrymen's association, and National Founders' association?

Shall this idea be sold to the rank and file of gray iron foundries at once, or shall something tangible first be built up through a comparatively small group of broadminded, far-seeing foundries that are able and willing to help, and later try to get the other foundries aboard the band wagon?

These are questions which require sound judgment and practical knowledge of the possibilities of co-operative work among the foundries.

To clarify thinking about these problems a tentative plan of organization might be outlined as follows:

To accomplish anything, the first step is to make a start. Therefore, agree at once to start some kind of a national association of gray iron foundries.

Widespread support at the start is impossible if the dues are too high. Before anything can be sold there must be a demand for it. The first activities of the association should be mainly propaganda among the gray iron foundries to show the objectives sought.

Start the dues at a nominal figure, say $10 or not over $25 per year. This will attract the largest possible number of members to enroll at the beginning. The number of foundries interested at these nominal dues will give better indication of the possible support for a more costly program involving higher assessments per foundry.

Organize the association and elect a temporary board of governors. This board then can assume definite responsibility for perfecting a national gray iron association.

A membership campaign could be inaugurated at once. In the meantime, the board of governors could make a thorough survey of the field to determine the following questions:

1. How large a budget can be financed, and what is the best method?
2. What are the most important and attainable objectives?
3. What assistance can we obtain from the American Foundrymen's association and the National Foundrymen's association, government departments, and other agencies? How can we best make use of their assistance?

These and other important problems should then be worked out with due

(*Concluded on Page* 203)

Chicago Club Plans Full Program

DAVID G. ANDERSON, chief foundry engineer, Western Electric Co., Chicago, has been elected president of the Chicago Foundrymen's club for the coming year, succeeding G. A. Rolinson, American Brake Shoe & Foundry Co. Roy Frazier, superintendent, Hansell-Elcock Co., Chicago, was elected vice president; Albert N. Wallin, of S. Obermayer Co., Chicago, was re-elected secretary. Members of the board of directors and the personnel of committees will be announced later.

The new officers already have mapped out a comprehensive program for the ensuing year. The subject of the March meeting is "Metallography," and the discussion will be on the fundamentals of reading the characteristics of a metal from its micrographs. "Cupola and Air Furnace Practice" will be the subject for discussion at the April meeting. Subjects for other monthly meetings will be as follows: May—"Electric Furnace Practice, Steel, Iron and Brass"; September—"Metallurgy"; October—"Castings in Competition with Fabricated Products"; November—"Permanent Mold Practice." Representatives from engineering societies will be invited to the October meeting with a view of creating further demand for castings.

DAVID G. ANDERSON

The Chicago Foundrymen's club has arranged for a special train to take the members to the Philadelphia convention of the American Foundrymen's association in May. A side-trip to Washington, also has been arranged. C. E. Hoyt, a member of the club and executive secretary of the American Foundrymen's association, will lay a wreath on the tomb of the unknown soldier in Arlington National cemetery, in behalf of the Chicago club.

Plans are being organized in a preliminary way for an elaborate exhibit of foundry technique at the Second Chicago World's Fair in 1933. The Chicago Foundrymen's club is sponsoring this exhibit, and it is understood financial aid is to be forthcoming for a large exhibit showing the history and development of the foundry industry.

Bill Looks Into the Situation Regarding Sand

By Pat Dwyer

TIME was, as the saying goes, when a man was recognized as the head of his house. He might not shine with any particular brilliance abroad, but the fact that he provided the where-with-all for keeping the family out of the hands of the sheriff and the old clothes man was regarded as sufficient reason for according him a certain measure of respect. The goodwife might have her own private opinion of his mental attainments and lack of the social graces, but she tactfully kept her opinion to herself or possibly shared it only with her dear, old nosey mother.

Disputed points of all kinds reached their climax in: "Well, you will have to ask your father," or "you know what your father said," or the famous old standby "you wait young man until your father comes home." So far as the family was concerned the father was the court of last resort, the personification of wisdom; Diogenes himself without the tub or the lantern.

Romantic literature of a past generation portrayed the hero, and by inference other members of the male sex, as a remarkably superior kind of a person who knew all things, who could do all things and who needed neither advice nor assistance from any human being. He was a sturdy oak capable of supporting not only himself but also a clinging vine fortunate enough to attract his distinguished attention and as many little clinging vinelets as Providence in its inscrutable wisdom saw fit to bestow upon him. Dear little girls grew up in this belief and in their early married life deferred to their husbands in all things. Later if circumstances caused them to change their opinions, which circumstances sometimes did, they found themselves hopelessly handicapped. Habit is second nature and a stern chase is a long chase. After playing second fiddle for such a long period, any attempt to lead the orchestra is hopelessly out of the question. They peacefully subsided into admiring echos of their dominant partners and deprecatingly admitted to all and sundry how fortunate they were in having been selected as partners by good providers.

Times have changed. The good old days are gone forever and the discouraging feature is that men have themselves to blame. The public chariot now is driven from the back seat. Man is merely a chauffeur; a kind of a handy man around the house. He is tolerated on account of his ability to sign checks on the first of the month—and at other times—but he requires constant care and attention and an everlasting stream of advice and correction.

This radical reversal of position is the result of steady propaganda extending back over a period of about twenty years. The most potent factor is the fiction magazine. Commencing with a few scattered women writers, this field now practically is usurped by a legion of tireless lady typists all relentlessly hammering on variations of the one theme.

A beautiful and talented girl wakes up from the honeymoon to find she is married to an uncouth creature without either style or ambition. He lounges around the house in undress uniform. He breaks her heart by refusing to dress up in full regalia for dinner or to wear a lovely embroidered smoking jacket afterward. Worst of all he is content to occupy a subordinate position in the office.

As the story progresses the reader is thrilled to learn how one by one she overcomes all these points of passive resistance. Gently but firmly she buys him the correct clothing and teaches him to wear the different garments to bring out his personality. Then comes the great coup. She visits him at his office and meets the big boss. This hard boiled old captain of industry melts as wax before the charm of her attractions. He spills the whole works; tells her all his troubles, including the baffling problem involving over $7,000,000 which he with his entire staff of high priced executives has been unable to solve. Her woman's unfailing intuition reveals the solution in a flash! That night she unfolds the brilliant scheme to the poor dumb brute who sits opposite her at the table. He is lost in admiration and makes an attempt to paw her over like an affectionate dog. She crisply tells him not to be silly, but to walk boldly into the ogre's office on the following morning and lay the proposition before him. His half hearted objections are met by a flood of pitiless logic and he retires to rest. In the cold, gray light of morning, the proposed interview loses some of its appeal.

NOW CHILDREN RUN AWAY TO BED AND UNCLE ED WILL TELL YOU ANOTHER STORY TOMORROW NIGHT

He has interviewed the boss before and found him about as responsive and genial as a hunk of pig iron. The omnipotent wifely eye notes the first faint fluttering of the white flag, the hangdog look, the goose flesh, the deprecating suggestion of postponement.

Although it hurts her cruelly to apply the lash, she realizes it is for his own good. She has no children, and never intends to have any, but the eternal maternal spirit is aroused. The dauntless mothers of Carthage sent their sons forth to battle with the priceless slogan: "Come back with your shield or on it!" Can she do less? Fat chance!

She applies the merciless goad of a sharp and bitter tongue to such telling effect that the embryo hero's appetite is ruined. He gulps a cup of near coffee, leaves the shredded wheat biscuit and the two prunes untasted and shoots through the door like the devil went through Athlone, in three standing jumps.

Desperate resolution drives him as far as the dragon's door twice during the first hour after his arrival at the office, but each time his courage fails and he retires to his high stool to rack his brain for a suitable excuse to present to the little pal. Then he is once more impaled on the horns of a dilemma by his wife's voice over the phone asking him for the result of the interview.

Driven to the limit of human endurance he slams the receiver on the hook and stalks into the lion's den. He does not care what happens. If the lion eats him, he hopes he chokes. If his widow fails to collect his insurance for want of a *corpus delicti*, he reflects it will serve her right.

Then the miracle happens. The old man listens courteously to his solution of the perplexing problem involving $7,000,000. He calls in his executive staff and has the explanation all over again. Oh's and Ah's of admiration salute the hero's ears from all sides.

He has arrived! Men who formerly ignored him or listened to his timid opinion with amused toleration, now regard him with respect and deference. The old man announces that hereafter Jones is to be his first assistant with absolute power to direct operations as he sees fit. In a private interview later he tells him in future to write his own pay check.

Women have been reading that kind of drivel for years and as in the case of the constant dropping which wears away the stone, they gradually have come to believe it. The fact that not a single one of them ever had a similar experience cheerfully is ignored as a factor of minor importance. They are firmly convinced that if their dumb husbands will listen to their advice they will walk right to the top.

Bill came in the other night while my mind was running in this groove and naturally I asked him if he had noted whither we are drifting.

"Drifting?" Bill inquired. "Drifting did you say? Lemme tell you something, young fella. The drifting period is nearly over. In about one more generation at the present rate of progress we'll be on the rocks figuratively and literally. Then the women will throw all the blame on

THE LITTLE PAL SHOWS HIM HOW DUMB HE IS

the men as usual, cheerfully retire from the scene, let the poor goats salvage what they can from the wreck and start the voyage all over again."

"Why not start a movement," I said, "to head this thing off before it goes too far? It seems to me we are criminally negligent in standing idly by while the good ship drifts on a lee shore."

"Too late," Bill replied. "She's so far on her way now that nothing will stop her before she strikes. Popular fiction has been getting in its nefarious work for many years and now the heavy advertising guns have been pressed into service. So long as the attack was directed from the center, the more or less pure reading pages, the men stood a fighting chance. Now with the center attack reinforced by bombardment from the advertising sections in the front and back of the magazine, total annihilation is imminent.

"One of these advertisements is ornamented with a picture of a lady and gentleman attired in correct evening clothes sitting on the back seat of a luxurious car on their way home from a friend's house. The lady, sparkling with animation—she probably slept all afternoon—is bitterly upbraiding her companion for acting so dumb during the evening seance.

"'I was ashamed of you,' she says, 'positively ashamed. All the other members of the party contributed their share to the evening's conversation while you sat there like a—like a—like little Billy Hooty in the old ivy tree. Not a peep out of you. If you have no regard for yourself, at least you might give some consideration to the embarrassing position in which you place ME.'

"What the lad probably thought in his own mind was: 'How could I help it? These birds chattered away about things about which I know nothing and in which I am not interested. Actors, pictures, plays, authors, books on goofy subjects, astronomy, past and future existence, and fifty other subjects of not the slightest importance.

"He did not say all this. Not likely. That would destroy the spirit of the advertisement. Also it would not give the lady the proper cue for the continuation of her lecture. Of course, she is bound to continue. Any person with even half an eye can see that in the determined attitude.

"Our hero runs true to form, as form has come to be understood in these degenerate days. Instead of bellowing 'SHUT UP' and thus starting a new argument, he handsomely admits that he was wrong all the way through, but dash it all what is a fellow to do? Where is he going to find time to familiarize himself with all these subjects?

"'My dear,' he says, 'you done fine, I mean did. You took part in the discussion of every subject. In fact in many instances you led the field. What I mean is, they seemed to kind of defer to you. You sounded the note of authority. I know you are as busy all day as I am. Tell me how do you do it?'

"Can you imagine a sweeter opening than that?" said Bill. "She has him at her—and the advertiser's—mercy. Taking candy away from a kid or the pennies from a blind man's cup is a real he-man's job in comparison. The reader is bound to continue reading, to find what the lady has to say. Believe me it is plenty. Strictly between ourselves, I don't mind admitting it is too much, but that is only a personal opinion. You know me, kid, a man of few words."

"Go ahead," I implored, "go ahead. Boil the thing down. What did the lady say? I am almost tempted to lay you a small wager there is a catch in it some place."

"Old play-'em-safe, eh?" Bill jeered. "Well, you are not going to lay any

wager, small or large with me on this thing. I'll say there is a catch to it.

"The lady graciously admits to her companion that at one time she knew no more than he does now. She felt out of place at social gatherings of the elect. Great waves of humiliation threatened to engulf her each time she found herself marooned while the sprightly chit-chat flowed all around her. She determined to break into the charmed circle. But how was she going to do it? Just as she had almost abandoned all hope a circular letter had arrived at her home announcing the publication of a marvelous book containing the concentrated essence of all knowledge conveniently arranged in short paragraphs. She secured a copy. By assimilating two or three of these paragraphs each day during her odd spare moments she easily had mastered the entire field of human knowledge. She casually mentions the name of the book, the name and address of the publisher and the price. In his enthusiasm the printer had set these various items in 14-point, Bold, all caps. Our hero registers the most intense joy and admiration over this peep into the promised land. 'By Jove,' he is quoted as saying (what he probably said was 'Hot Dog!') 'By Jove,' he says, 'I'll start in on that book this very night before I retire.'

"The implication in the advertisement is that the idle chatter of idle people in an idle hour is of paramount importance. Because the man could not take part he is classified as a blockhead. The fact that he could afford a luxurious car, evidence of reward for contributing his share to the world's work, calmly is ignored.

"In this highly specialized and highly competitive age a man has pretty nearly enough to do in mastering the details of his own business. The task of discussing the Einstein theory, the nebular hypothesis and companionate marriage may be left to those who have nothing else to do. As our old friend Jeremiah remarked long ago it is nothing but the crackling of thorns under a pot.

"The foundry business constantly is presenting problems to those engaged in it. I had an inquiry the other day from a man who said that the sand on his benches and squeezers for fine high grade castings seemed to be satisfactory in every respect except that it cuts on some of the castings. He asked me to recommend a sand for his work, also how to treat his present supply. He concluded by asking me if I did not think foundrymen should start a campaign to wake up sand producers.

"Taking the last question first I replied that no doubt he would be interested to learn that the American Foundrymen's association for many years has been working on the subject of sand classification in an endeavor to formulate a set of specifications for the guidance of both buyer and seller. The various committees have made notable progress as evi-

HE HAS THE situation WELL IN HAND

denced by the reports submitted at the annual conventions, but a great deal of work yet remains to be done. All the large and reputable sand supply companies are keeping closely in touch with the work of the American Foundrymen's association and are prepared to furnish customers with sand to meet certain definite specifications in chemical analysis, bond, permeability and grain size. Several of the more prominent sand producers maintain elaborate research laboratories where work continually is going forward on different phases of sand in its relation to the foundry industry. Also, they maintain consulting staffs who investigate customers' requirements and conditions and then specify a certain grade of sand and conditions under which it is to be used.

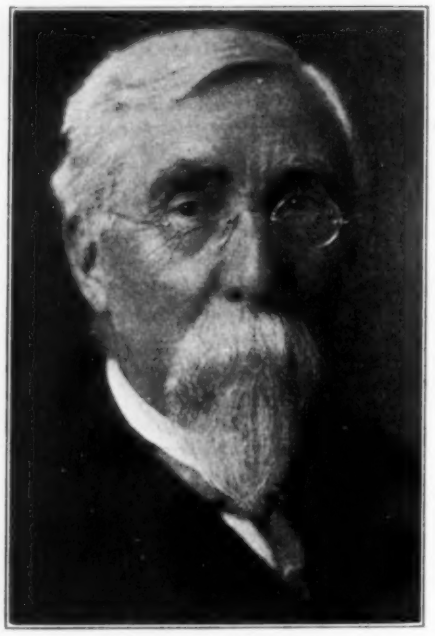
"On account of the loose and indiscriminate manner in which terms are employed in the foundry I was at a loss to determine without an actual examination of a casting whether the sand has too little or too much bond. If he was using the term *cut* in its proper sense, that is to describe a more or less rough area caused by a stream of metal cutting its way, then apparently the sand was not sufficiently bonded to resist erosion. Naturally this condition is most noticeable in the vicinity of the gates where the stream of metal travels with greatest velocity.

"However, if he was referring to a scabbed area or to one in which the sand appears to be melted on the surface of the casting, then without doubt the trouble was due to excess of bonding material. The scabs were due to sand that was too *tight* for the passage of steam and the tightness was caused by an excess of fine bonding agent that closes the interstices between the grains. Presence of the same excess of bonding material lowers the fusion point of the sand and allows some of the bonding agent to melt and unite with the iron on the surface of the casting. If he was right in his first contention that the sand was lacking in bond, he can remedy the situation by the addition of any one of a number of bonding agents including special clay in dry or liquid form. In some cases probably a light spray of molasses water or of any other water soluble core binder will be sufficient over the face of the mold. It might be necessary to mix the binder with a facing sand to be used for covering the pattern.

"If the sand really carried an excess of bonding material, it may be worked successfully in some cases, by easing off on the ramming, by extra venting, by cutting down on the moisture content and in extreme cases by the addition of fine sharp sand to the facing mixture.

"In many cases a perfectly good sand is blamed for defective castings that really are due to faulty molding practice. I suggested a thorough check-up on every feature in connection with the production of the castings, before taking any action with the sand. Then if the blame positively was laid on the sand, remedial measures should be applied until the supply is exhausted. Subsequent purchases could be made from producers whose sands have proved satisfactory under similar conditions.

T. B. Cram, for over 19 years connected with the furnace industry, has become associated with Holcroft & Co., Detroit, contracting engineers.



HENRY M. LELAND
teacher,—counselor, friend—

He Looks Back Over the *Long, Long Trail*

HENRY MARTYN LELAND, pioneer automobile builder and prominent for almost 40 years in the industrial history of Detroit was prompted recently to throw a retrospective glance down memory's lane when 85 special friends from the hundreds of nationally known leaders in all sections of the commercial and industrial field waited upon him and extended affectionate greetings and felicitations on the occasion of his eighty-fifth birthday.

Although he retired several years ago from active participation in the affairs of the companies with which he so long was prominently identified, he still maintains contact with a wide circle of men who through one cause or another accompanied him for varying distances on the long, long road. He has been teacher, counselor, friend and inspiration to thousands who have achieved prominence and who hold him in respectful admiration. The bright twinkling eyes present a truer indication of his mental age, outlook and capacity for making and holding friends, than the patriarchal beard or the still luxuriant white hair.

From all avaliable reports it is apparent that Mr. Leland is in no immediate need of assistance to meet the monthly assaults of the butcher, the baker or even the candlestick maker known under the modern name of the Detroit Edison Co. Rumors are current to the effect that he has sufficient of the root of all evil to see him comfortably through the next 85 years, thereby, offering marked contrast to the condition under which he started the first 85 or many of the years following that event. The first few stages of memory's lane down which Mr. Leland gazed the other day were filled with flickering visions of care free and joyous hours in which his entire earthly possessions were represented by the clothes on his back. Careless alike of the past or the future he arrived at the exceedingly mature age of 14, and then decided it was about time he was doing a man's work in the world in exchange for his board and clothes.

He has been doing it ever since, not only the work of one man but the work of many men and as hereinbefore mentioned, it is claimed that he always has paid his own way and even managed to accumulate a trifling reserve for the proverbial rainy day. Thrifty people, these Down-east Yankees.

Henry M. Leland was born in Danville, Vt., Feb. 16, 1843 and after lapping up the usual boy's dose of the three *Rs* in the schools of that town he went forth to seek his fortune and settled upon Worcester, Mass., as a likely place for the purpose. He worked for a year helping to make carriage wheels and then quit gladly to enter the old George Crompton Loom Works as an apprentice machinist, a line which with minor variations he followed for the remainder of his active existence. Also by a curious combination of circumstances he was forced to take up automobile building rather late in life, thus beginning and ending his working days in connection with pleasure vehicles.

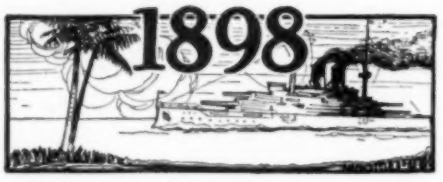
A skilled tool maker at the age of 19 he entered the United States armory at Springfield, Mass., in 1862 and remained there until 1865. He worked for a year at Colt's armory in Hartford, Conn., and as a machinist and toolmaker in several Worcester shops until 1872 when he secured employment with the Brown & Sharpe Mfg. Co., Providence, R. I. He remained with this institution, famous for the number of high grade graduate machinists, toolmakers and engineers it has sent into the field, for 18 years during a considerable part of that time as superintendent of the sewing machine department.

(*Concluded on Page* 202)

MILESTONES

in Foundry Progress

As Recorded in the March Issues of THE FOUNDRY, Thirty, Twenty and Ten Years Ago



WILLIAM PHILLIP ABENDROTH, one of the oldest and most prominent foundrymen of that period, died at his home in Port Chester, N. Y., according to a story in THE FOUNDRY of March 1, 1898. The firm of Abendroth Brothers, in that same city, keeps alive the name in the foundry industry. Mr. Abendroth, according to the article in question was born in 1818, in Germany.

* * *

His life and that of his successors has bridged the century in the foundry industry.

* * *

The foundry of H. Bollinckx, Brussels, Belgium, is briefly described, as of thirty years ago.

* * *

This was a sizable shop, with liberal skylights, molding machines, which rolled over the flask and provided a pattern draw, but with no ramming or squeeze feature provided. But how would one pronounce the name of the owner?

* * *

Numerous mixtures for different castings were contributed by correspondents. One for pulley castings gave the following recipe: Hamilton, 400 pounds, Todd, 300 pounds, Cherry Valley, 200 pounds, Franklin, 100 pounds, machinery scrap, 1000 pounds.

* * *

Further, deponent sayeth not. What of the magic numbers 1, 2 and 3 as limiting the silicon content? Carbon, manganese, phos and sulphur, where are they? And this was only 30 years ago.

* * *

F. O. Farwell described a multiple molding machine, with particular reference to its application to sash weights. The machine employed a turret head, which could be swung into position above the filled flask. One of the heads provided, served to press the sand firmly into place. Then the other head was brought into play to bed the patterns in. The molds were stacked, the cope of one serving as the drag of the succeeding mold, while a continuous gate was cut from top to bottom of the stack.

* * *

The American Bronze Foundry Co., Chicago, was incorporated by Paul Cornell Jr., Jules Bercham and J. A. Graves.

* * *

This shop cast many important art bronzes in later years, including the lions that adorn the entrance to the Art Institute, the Great Lakes group, all of Chicago and others.

* * *

The Vulcan Iron Works, Chicago, one of the city's oldest shops, constructed in 1861, was burned to the ground.

* * *

The Editor waxed indignant over the anti-trust suit decided against half a dozen producers of cast-iron pipe, remarking that only a short time before one of the leading eastern pipe shops had gone into receivership due to low prices obtaining since 1893.

* * *

A New England foundry was said to be quoting general gray iron castings at $1.13½ a hundred weight.

* * *

RUTHLESS RHYMES

Prices of the nineties, gay,
Remind the founders of today,
Cutting pennies from their offers
Never fills the owners' coffers.

Those who whittled down the figure,
Just to make production bigger,
Long ago have pulled their freight,
Gone to their predestined fate!

A. V.

SILICON-COPPER in the Brass Foundry," a contribution awarded first prize in a contest conducted by THE FOUNDRY appeared in the March, 1908, issue. The author was Charles Vickers, who long has been nonferrous editor of this publication.

* * *

Richard Moldenke, in an extensive article outlined the results of tests on the effect of vanadium on cast iron.

* * *

J. F. Buchanan presented an interesting discussion of core molding, which for want of a better term was taken to indicate that type of molding wherein not only the part of the mold which forms the internal portion of the casting, but that which forms the outside, also, is made from baked sections made in core boxes.

* * *

The ideas involved were adopted in large measure by the makers of automobile cylinder castings in the early days.

* * *

Announcement was made of the intention of the American Foundrymen's association to hold its 1908 convention in Toronto.

METHODS for making semisteel shell in France were given in the leading article of THE FOUNDRY for March, 1918. This article was written by M. E. Ronceray, eminent French authority on foundry practice and manufacturer of equipment.

* * *

This was one of the many valuable contributions on the manufacture of war materials that appeared in THE FOUNDRY *during the period following our entry into the conflict.*

* * *

Dwight D. Miller gave some interesting facts on the electrical melting of nonferrous metals.

* * *

How the American Cast Iron Pipe Co., Birmingham, Ala., made cast iron pipe was covered in a 13 page article.

* * *

This plant later was a pioneer in the production of cast iron pipe in sand lined iron molds, rotated at high speed on a horizontal axis.

* * *

W. E. Hoblitzelle was made general manager of the Duquesne Steel Foundry Co., Duquesne, Pa., to serve in place of Maj. R. A. Bull, who was in war service in France.

* * *

The personal columns were filled with mention of foundrymen who were answering the call to duty in the army or in the service of supplies.

* * *

Shortage of low phosphorus pig iron was embarrasing steel foundries on the delivery of war materials.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ Castings on Parade

ONE of the most interesting and ambitious features of the forthcoming exhibition of the American Foundrymen's association planned for Philadelphia during the week of May 14, is the display of castings recently announced. This exhibit, which will be housed adjacent to the extensive hall in the Commercial museum where the last word in foundry equipment and supplies may be studied, will be divided into three sections. These will feature steel, malleable and gray iron castings.

THE Malleable Iron Research institute has been asked to sponsor the display of those factors relating to the special class of castings made by its members, and by others in this branch of the industry. Similarly, the Steel Founders' Society of America has been asked to be responsible for the steel castings exhibit. Inasmuch as no organization represents the gray iron interests, a special committee is being formed to act in a similar capacity for the gray iron display. This committee will seek castings, test specimens, data, charts and photographs supporting the different qualities of cast iron.

IN PLANNING these exhibits, the merits, uses, serviceability and importance of castings will be advanced. True, the exhibition at this time largely will be viewed by foundrymen, but experience has shown that even those most intimately connected with the industry many times fail to appreciate the worth of the products they make. Such features as are developed at this time will be stressed. The data gathered will be given wide publicity. Perhaps, it may be possible to assemble a permanent exhibit to be shown before gatherings of engineers, manufacturers and others who specify or use cast products. In this connection, no effort will be made to deprecate other fabricated metals. The misrepresentation of some forms of competing products within the past few years has reacted upon those who have resorted to such tactics. The merits of castings will be presented without prejudice.

¶ Conference Is Needed

MEETING in Pittsburgh on call of the committee of the Philadelphia Foundrymen's association and a group of mid-western gray iron castings producers, the conference on the gray iron problem planned for March 13 should be productive of ideas. During the past several years, sporadic statements have been made as to the state of this industry and various suggestions have been advanced for its improvement. Undoubtedly, the position of gray iron castings has been injured and the business fortunes engaged in this branch of the industry have been impaired. Whether this is due to fundamental conditions, a swing of popular favor away from iron castings, or whether it is an internal condition arising from overcapacity, nonuniformity of product or perhaps all these factors, is open to proof.

RESEARCH has been given as the answer to the problem. Some holding to the opinion that the quality of product was at fault, have favored intensive research along technical lines. Perhaps they are right; but before any broad, hazy and indefinite policy of scientific research is adopted, should not a study be made of existing information, followed by an application of what already is known about this metal? Further, are not present facilities available and ample to handle any advanced study of metallurgical and manufacturing problems? These and other points such as the commercial, trade practice and business angles of the gray iron situation will center interest in the forthcoming conference.

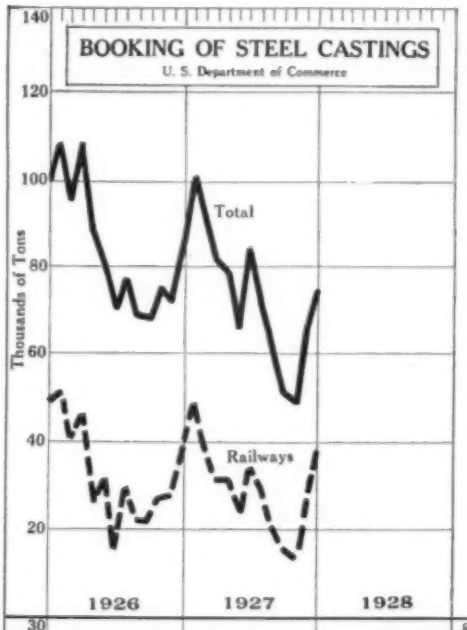
ON OTHER pages of this issue of THE FOUNDRY, viewpoints on the gray iron situation are presented. These follow articles presented during the past two or three years bearing upon the same subject. In presenting these discussions, it is the intention of this publication to assist in the interchange of information, discharging its obligation to the gray iron branch in this manner, and seeking in no way to dictate policies or procedure. Further constructive discussion is invited.

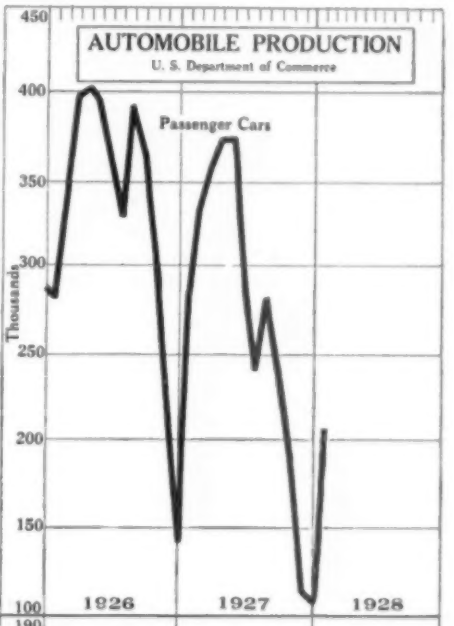
Trade Trends in Tabloid

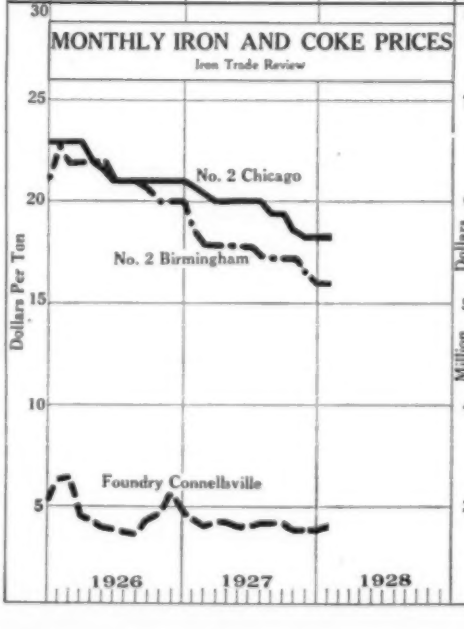
CONFIDENCE is expressed in improving conditions in the foundry industry. The car awards in January totaled over 3900 freight units and the first portion of February saw this figure equalled, giving assurance of castings demand from the railroads. Automotive shops, with few exceptions, are busy and those which depend upon jobbing sources for castings are ordering in anticipation of increased output of cars. Cast iron pipe shops are operating at 70 to 75 per cent of capacity, with orders on their books for six or eight weeks in advance. Building awards show an upward trend which is unusual in this season of the year. Demand for heavy electrical and machinery castings is bringing a steady volume of orders for castings to certain heavy foundries in Canada. The upturn in the iron and steel industry is reflected among foundries in the Pittsburgh and Valley districts. Purchases of iron by the larger interests, notably the railway, sanitary ware and pipe shops indicate a comfortable assurance of steady business for the late spring and summer. Sales of retail stores and mail order houses, freight car loadings and statements of bank clearings all testify to an increase in volume of business since the first of the year. Nonferrous foundry operations, which were slack during the midwinter are showing signs of improvement, particularly in automotive and plumbers goods

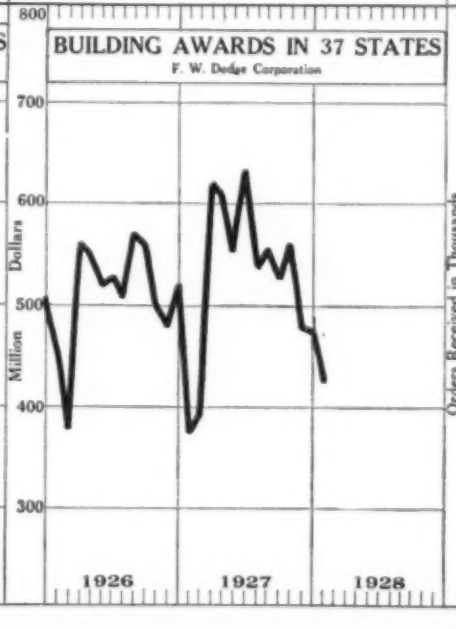
RAW MATERIAL PRICES
Feb. 22, 1928

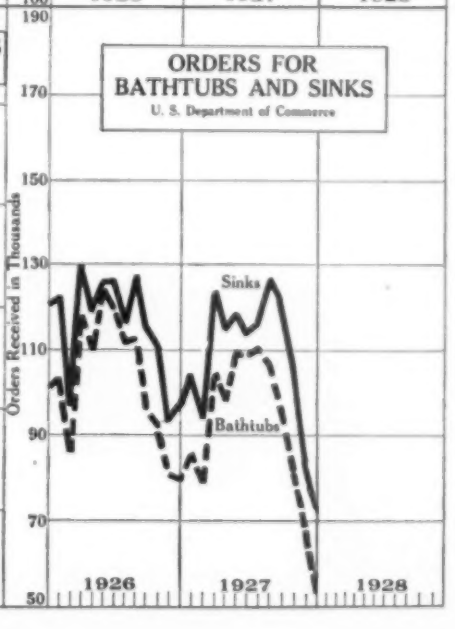
Iron	
No. 2 foundry, Valley	$17.25
No. 2, southern, Birmingham	16.00
No. 2 foundry, Chicago	18.50
No. 2 foundry, Philadelphia	20.26 to 20.76
No. 2, foundry, Buffalo	17.00
Basic, Valley	17.00
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	18.50
Malleable, Buffalo	17.50
Coke	
Connellsville foundry coke	$3.75 to 4.25
Wise county foundry coke	4.00 to 5.00
Scrap	
Heavy melting steel, Valley	$15.00 to 15.25
Heavy melting steel, Pitts	14.50 to 15.00
Heavy melting steel, Chicago	13.00 to 13.50
Stove plate, Chicago	12.00 to 12.50
No. 1 cast, New York	13.00 to 13.50
No. 1 cast, Chicago	14.00 to 14.50
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Pittsburgh	14.50 to 15.00
No. 1 cast, Birmingham	14.00 to 14.50
No. 1 cast, Buffalo	11.50 to 12.00
Car wheels, iron, Pittsburgh	14.25 to 15.00
Car wheels, iron, Chicago	14.25 to 14.75
Railroad malleable, Chicago	12.75 to 13.25
Agricultural Msl., Chicago	11.75 to 12.25
Malleable, Buffalo	15.25 to 15.75
Railroad malleable, Pitts	14.50 to 15.00
Nonferrous Metals	Cents per pound
Casting copper, refinery	13.75
Electro copper, producers	14.00 to 14.12½
Straits tin	51.37½ to 51.50
Lead, New York	6.25
Antimony, New York	10.75
Nickel, electro	37.00
Aluminum, No. 12, producers	23.00
Aluminum, No. 12, remelt	17.00 to 17.50
Zinc, East St. Louis, Ill	5.45











Personal

Wilfred R. Friech has been made general foreman of the Brown & Sharpe Mfg. Co., Providence, R. I. Mr. Friech was general foreman of the Alaska Freezer Co., Winchendon, Mass., for 12 years and then held similar positions with the Toy Town Freezer Co., Winchendon, and the Louis Sacks Iron Foundry, Newark. N. J.

Robert Elliott, for many years connected with the Mt. Vernon Car Mfg. Co., Mt. Vernon, Ill., has been appointed assistant superintendent. Arthur Maulding has been appointed general foreman of the steel plant of that company.

George T. Johnson has been made third vice president of the Buckeye Steel Castings Co., Columbus, O., in charge of engineering and sales. Mr. Johnson has been connected with that company since 1906.

Dr. Richard Moldenke addressed the members of the Newark Foundrymen's association Feb. 17 on "The Future of the Gray Iron Industry."

J. Ramsay Speer, president, Mackintosh-Hemphill Co., Pittsburgh, spoke before a meeting of the Pittsburgh Foundrymen's association, Feb. 20, on "Where Does the Foundryman Find His Profit." Mr. Speer is a graduate of the Massachusetts Institute of Technology, Cambridge, Mass., and edited the *Chronology of Iron and Steel*, which was published in 1920.

Charles Pasche has been made president of the Davenport Locomotive & Mfg. Corp., Davenport, Iowa, succeeding F. Parmly Jr. Mr. Pasche has been connected with that company since 1901 and formerly was secretary and treasurer. He will continue in the latter capacity.

J. W. Collins, foundry superintendent, the U. S. Aluminum Co., Detroit, addressed the members of the Quad City Foundrymen's association on the subject of "Aluminum Castings" at a meeting held in Moline, Ill., Feb. 20. Mr. Collins served a regular apprenticeship as a molder in Canada before coming to the United States in 1905. From 1905 to 1910 he worked in a number of jobbing shops in Detroit. Since 1910 he has been in the aluminum foundry business. In 1912 he took charge of the Detroit foundry of the U. S. Aluminum Co.

David G. Anderson, elected president of the Chicago Foundrymen's club, is in charge of the staff of foundry development engineers, Western Electric Co., Chicago. He formerly was general superintendent of the Pittsburgh Engineering Co. and has a wide experience in building and operating foundries. He has contributed to the progress of foundry practice by numerous novel devices and patents. He is a member of the American Foundrymen's association, the Chicago Foundrymen's club and the Swedish Society of Engineers.

R. G. ABBEY

Represents Sly Company

R. G. Abbey has been appointed district manager for the W. W. Sly Mfg. Co., Cleveland, with offices at 50 Church street, New York. He will handle a complete line of equipment manufactured by the Sly company in the territory formerly in charge of the late D. P. Carter. Mr. Abbey was graduated from the Case School of Applied Science, Cleveland, in 1923 with a degree in engineering and spent one year with the C. G. Spring Co., Cleveland. He then joined the W. W. Sly Co., and has since served in various capacities.

Committee Nominates Officers for 1928

The nominating committee of the American Foundrymen's association met in Cleveland Monday, Feb. 6. This committee was composed of three past presidents, G. H. Clamer, Ajax Metal Co., Philadelphia; L. W. Olson, Ohio Brass Co., Mansfield, Ohio, and A. B. Root Jr., Hunt-Spiller Mfg. Corp., Boston, acting with the following elected from the membership: T. S. Hammond, Whiting Corp., Harvey, Ill.; H. B. Swan, Cadillac Motor Car Co., Detroit; Werner G. Smith, Werner G. Smith Co., Cleveland; and Albert Weber, Wilson Foundry & Machine Co., Pontiac, Mich.

This nominating committee announced the following for election: S. T. Johnston, S. Obermayer Co., Chicago, president; Fred Erb, Erb-Joyce Foundry, Vassar, Mich., vice president; and the following for directors: S. W. Utley, Detroit Steel Casting Co., Detroit; L. W. Olson, Ohio Brass Co., Mansfield; B. H. Johnson, Cresson-Morris Co., Philadelphia; Peter J. Krentz, Buffalo Foundry & Machine Co., Buffalo; C. E. Hoyt, secretary, American Foundrymen's association, Chicago.

Unless other nominations are made by unanimous choice of twenty-five members of the American Foundrymen's association, signifying such additional nominations as their choice, and within sixty days prior to the annual convention in Philadelphia, those whose names appear on the list previously mentioned will be declared unanimously selected.

He Looks Back Over the Long, Long Trail

(*Concluded from Page* 198)

In 1890 he moved to Detroit where he formed the Leland & Faulconer Mfg. Co., to engage in the manufacture of special machinery. The growth and success of the company typified his progressive and efficient methods and the works attained a national reputation. Entering the automobile industry at its inception, Mr. Leland brought into play his inventive mind and his extensive, practical knowledge of mechanical equipment. He is responsible for many of the changes and improvements in engineering and production that mark this period.

In 1902 he helped to organize the Cadillac Automobile Co. and in 1905 the two companies were merged as the Cadillac Motor Car Co., Detroit. He served as general manager until 1909 when he became president and advisory manager. Later he founded the Lincoln Motor Co., primarily for the production of airplane engines, but later for the production of the well known car of that name. He has been a member of the American Iron & Steel institute, National Association of Manufacturers, National Founder's association, National Metal Trades association and others. He now is taking his ease at his residence 2984 West Grand boulevard, Detroit.

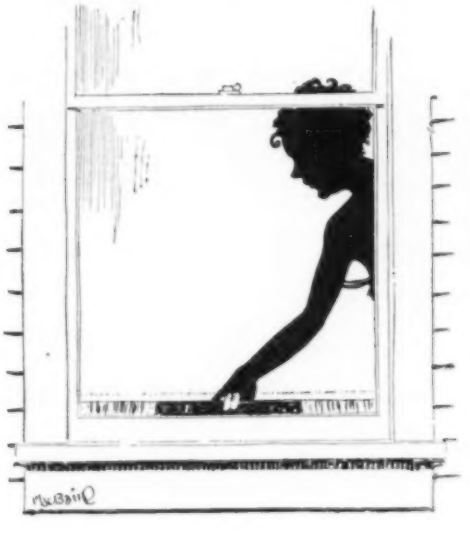
Equipment Manufacturers Elect Officers

At the annual meeting of the Foundry Equipment Manufacturers association, held in Cleveland, Feb. 7, the following officers were elected for the ensuing year: President, S. C. Vessy, W. W. Sly Mfg. Co., Cleveland; vice president, Henry W. Standart, Northern Engineering Works, Detroit. H. Cole Estep, Penton building, Cleveland, was re-elected secretary-treasurer. Mr. Standart was also elected a director for the term ending February, 1931, together with A. F. Jensen, Hanna Engineering Works, Chicago. Mr. Vessy was re-elected a director. In addition to the foregoing the board now includes T. W. Pangborn, Pangborn Corp., Hagerstown, Md., past president, and E. O. Beardsley, Beardsley & Piper Co., Chicago.

The report of the secretary-treasurer showed that the association has reached a high point in number of members and financial resources. The reports on business conditions presented at the meeting showed that somewhat better conditions have prevailed since the first of the year. It was agreed at the meeting to take steps to enlarge and amplify the statistical work of the association.

The members were addressed by Whiting Williams, Cleveland, on the subject "What Is Industry Doing to Us?" and by E. F. DuBrul, manager, National Machine Tool Builders association, who discussed the possibility of common action between trade associations to invoke those provisions of the Clayton act relating to unfair practices with respect to unethical buying methods.

Faked Foundry Facts



A Blind Draw

Outlines Objectives

(*Concluded from Page* 194)

deliberation by the best minds available in industry. And the board will feel that they are duly authorized to represent the gray iron foundries of the country and have a definite responsibility to fulfill.

In the meantime, the association has been organized, the membership campaign is being pushed and when the board is ready to recommend further action, the idea of a national gray iron association will have been erected upon which a strong enduring structure can be built.

This plan does not involve any actual expenditure for research or cost work at the start. Some may be impatient, and think further delay in starting this important work is ill-advised. But in view of the serious difficulties to be overcome, it will be much better not to be too precipitate but to build slowly and carefully and not let the program run ahead of the demand for it.

Foundry Association Directory

American Foundrymen's Association

President, S. W. UTLEY, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. HOYT, 140 South Dearborn street, Chicago; technical secretary, R. E. KENNEDY, 909 W. California street, Urbana, Ill. Annual convention in Philadelphia, May 14-18.

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings on third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, DAVID G. ANDERSON, Western Electric Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 W. Eighteenth street. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, J. J. BOLAND, Griffin Wheel Co., Detroit; secretary, ROBERT HOPE, Holley Carburetor Co., Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

East Bay Foundrymen's Association
Oakland, Calif.

Secretary, H. L. MARTIN, Marchant's Foundry Co., 4401 East Tenth street, Oakland, Calif.

Metropolitan Brass Founders' Association
New York

President, WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, CHARLES F. MILLER, Universal Winding Co., Providence, R. I.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, C. C. SMITH, Toledo Steel Casting Co., Bancroft and Smoad avenue, Toledo, O.; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, Union League club, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building, Atlanta, Ga.

Pittsburgh Foundrymen's Association
Pittsburgh

President, C. D. CAREY, American Steel Foundries, Pittsburgh; secretary-treasurer, WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, HYMAN BORNSTEIN, Deere & Co., Moline, Ill.; secretary-treasurer, H. A. DEANE, Deere & Co., Moline, Ill. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Tri-City Technical Council
Moline, Ill.

Chairman F. V. SKELLEY, Tri-City Railway Co., Rock Island, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, H. H. NOTT, Smith System Heating Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meetings monthly at the Athletic club.

Washington Foundrymen's Club
Seattle

President, RONALD KUCHER, Olympic Foundry Co., Argo Station, Seattle; secretary, EDWARD C. GUSTIN, The Prescott Co., 1 West Lander street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks' Temple, Fourth avenue and Spring street.

What the Foundries Are Doing

Reflecting the Activities of the Gray Iron, Malleable, Steel and Brass Shops

Mason Foundry Co., Laurel, Miss., has purchased structural steel for a plant addition.

Crown Pipe & Foundry Co., Jackson, O., is building an addition to its pipe foundry.

Temple Malleable Iron & Steel Corp., Dover, N. J., has been incorporated to engage in the general foundry business.

Wellston Mfg. Co., Wellston, O., H. D. Wendell, president, is inquiring for machinery and equipment for pattern plant, recently damaged by fire.

Paxton-Mitchell Co., James L. Paxton, president, 2614 Martha street, Omaha, Nebr., will build a 1 and 2-story foundry. Austin Co., Cleveland, is the engineer.

Bridesburg Foundry Co., Philadelphia, has been incorporated with $30,000 capital to manufacture castings, patterns, dies, etc., by Harry Burgin, 4608 Salmon street, Philadelphia.

Waukegan Foundry Co., Waukegan, Ill., recently elected officers as follows: A. K. Barr, president; E. L. Clavey, vice president; E. E. Skidmore, secretary-treasurer.

Newman Machine Co., Jackson street, Greensboro, N. C., maker of woodworking machinery, plans to build a 1-story addition, 60 x 135 feet. Later it is planned to build a 1-story foundry addition.

Hamilton Diuguid, Brooklyn, N. Y., has been incorporated with $20,000 capital to engage in the iron and brass foundry business by F. J. Parks, 55 Liberty street, Manhattan, attorney.

Porter-McLeod Machine Tool Co., Hatfield, Mass., has been incorporated with $75,000 capital to operate a foundry and machine shop by Robert A. Johnson, 139 Wenonah road, Longmeadow, Mass.

Lumen Bearing Co., Buffalo, has elected officers, as follows: President, treasurer and general manager, Noah F. Young; vice president, C. H. Bierbaum; secretary, Nathaniel K. B. Patch; directors, the officers and A. G. Bartholomew and Samuel Ellis.

Rauen-Hartnett Foundry Co., 308 West Ontario street, Chicago, has been incorporated with 150 shares no par value stock to manufacture and deal in raw and finished steel and iron products, with Ross C. Hal, 307 North Michigan avenue, correspondent.

Rogers Iron Works Co. is the name adopted after consolidation of the Rogers Foundry & Mfg. Co., Joplin, Mo., and the Joplin plant of the United Iron Works. The company will manufacture and repair mining machinery. (Noted Dec. 15).

United States Cast Iron Pipe & Foundry Co., Burlington, N. J., is negotiating for the purchase or leasing of the old plant in Billings Park, Superior, Wis., abandoned for 25 years, to install complete machinery and equipment for the manufacture of cast iron pipe.

Monks Humidifier Co., Portland, Ore., has been incorporated by Tom N. Monks, Arthur M. Moore, and R. A. Stewart, to conduct a brass and iron foundry and machine shop. The incorporation was filed by George G. Israelson, 521 Spaulding Bldg., Portland.

Quality Aluminum Casting Co., Waukesha, Wis., has awarded the general contract for a foundry addition 39 x 200 feet to Paul Gierke, 816 Lincoln avenue, Waukesha. The steel work has been awarded to the Lakeside Bridge & Steel Co., North Milwaukee, Wis. (Noted Jan. 15).

Cost Rite Co., 2750 Van Buren street, Chicago, has been incorporated with $250,000 in preferred shares and 10,000 shares no par value stock to manufacture and deal in aluminum and other metal products, with Lamb, Foster & Pope, Monadnock block, correspondents.

The Standard Sanitary Mfg. Co., Pittsburgh, is making preliminary arrangements to erect manufacturing plants in foreign countries. The program will cover a period of several years. While the amount of money to be spent in foreign development has not been announced, immediate steps are being taken to get the project under way.

Chateaugay Ore & Iron Co. has completed the erection of a small steel castings plant at Standish, N. Y., where its blast furnace is located. This foundry is equipped with two small converters and the product at present is limited to mine car wheels, mine pipe and miscellaneous requirements for related companies.

The board of directors of the Eastern Malleable Iron Co., Naugatuck, Conn., recently elected the following officers: Howard B. Tuttle, chairman; Charles L. Berger, president; E. Mannweiler, vice president; George B. Woolson, secretary and treasurer, and Clarence E. Jones, assistant treasurer. Nelson S. Spencer of Boston, and Donald S. Tuttle and Austin L. Adams, both of Naugatuck were newly elected to the board.

W. A. Jones Foundry & Machine Co., Chicago, has elected officers, as follows: President, Warren G. Jones; vice president, George W. Page; treasurer, William F. Coleman; secretary, John A. Sizer. The officers and W. A. Jones form the board of directors. G. W. Page, elected vice president, also is director of purchases and has been with the company almost 30 years. William F. Coleman, elected treasurer, has been with the company many years and also holds the position of general superintendent.

New Trade Publications

AIR COMPRESSORS—General Electric Co., Schenectady, N. Y., has published a loose leaf folder giving features of construction of its centrifugal air compressors. Operating characteristics and ratings also are supplied.

WELDING RESISTORS—General Electric Co., Schenectady, N. Y., has issued a bulletin on its auxiliary welding resistors. It is illustrated and contains wiring diagrams and engineering data.

CHAIN HOISTS—A spur-geared, ball-bearing chain hoist is described in a bulletin by the Dickerman Hoist Mfg. Co., Cleveland. Illustrations show the hoist entire and disassembled and each part is fully described.

HOISTS—Hanna Engineering Works, Chicago, has published a catalog describing the various features of its air hoists. Data and dimensions of the different types are given.

GRINDING—Norton Co., Worcester, Mass., has issued a pocket size catalog presenting data on its segmental chucks and segments for surfacing iron and steel with large areas.

SUPPLIES—Brass Founders' Supply Co., Newark, N. J., has issued a catalog on equipment and supplies for the brass, bronze, aluminum, iron and steel foundries. The various types of equipment are shown by illustration. Sizes and data on the equipment and supplies also are presented.

ACETYLENE GENERATORS—Alexander Milburn Co., Baltimore, has issued a 4-page loose-leaf folder describing its acetylene generators for oxy-acetylene welding and cutting apparatus.

OIL BURNERS—Alexander Milburn Co., Baltimore, recently has published a 4-page folder showing its oil burners and preheaters for welding, boiler, machine and repair shops. These also may be used in foundries, by railroads, etc.

NICKEL—The International Nickel Co., New York, has published three pamphlets dealing with nickel additions to cast iron and steel. Two pamphlets show applications of nickel cast iron and methods of making the additions. The other gives notes on machining nickel alloy steel.

WELDING EQUIPMENT—The Torchweld Equipment Co., Chicago, has published a pocket-size catalog describing its various types of welding and cutting torches, cylinder manifolds, regulators and acetylene generators.

SPEED REDUCERS—Albaugh-Dover Mfg. Co., Chicago, recently has issued a catalog describing its speed reducers for machinery drives. The units are supplied with full ball or a composite of ball and roller bearings. Dimensions of the various types of units are given.

SPECTROGRAPHS—Adam Hilger Ltd., London, has published a bulletin on some recent applications of the spectrograph to metallurgical analyses.

AIR COMPRESSORS—Sullivan Machinery Co., New York, has issued two catalogs describing two types of air compressors. One is devoted to its belt driven single stage compressors and the other to its vertical, direct-motor driven compressors. Features of construction and capacities of each type are presented.

MOTORS—Louis Allis Co., Milwaukee, has issued several catalogs describing its self-starting squirrel cage motors, inverted rotary converters, totally enclosed and externally cooled squirrel cage motors and its multi-speed squirrel cage alternating current motors.

PUMPS—The Pennsylvania Pump & Compressor Co., Easton, Pa., shows in its recent catalog the features of construction and capacities of its double suction single stage centrifugal pumps.

RECORDING METERS—Supervision of electrical consumption as a means of reducing power demand charges is discussed in a bulletin by the Esterline-Angus Co., Indianapolis. Graphic records from meters specially designed for this purpose point out troubles that may carry costs to a high level, and indicate what changes may aid in reducing them.

CENTRIFUGAL AIR COMPRESSORS—Small, multi-stage centrifugal air compressors form the subject of a bulletin by the General Electric Co., Schenectady, N. Y. Illustrations show installations and detail drawings indicate construction. Engineering data are included.